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WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - --ETC(U)

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WASTEWATER ENGINEERING AND MANAGEMENT PLAN

FOR

BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA

EMMA STUDY

TECHNICAL DATA VOL. 9

MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS

(1)

OCTOBER 1975

INDEX TO EMMA STUDY REPORTS

COVER PHOTOGRAPH

The cover photograph on this Technical Data Volume depicts the front of the Alewife Brook Pumping Station. This photograph was taken in the late 1800's.

(6)

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR -- EASTERN MASSACHUSETTS METROPOLITAN AREA EMMA STUDY

TECHNICAL DATA ~~VOL 9~~ Volume 9.

MDC INTERCEPTOR AND PUMPING STATIONS ANALYSIS AND IMPROVEMENTS

FOR THE

METROPOLITAN DISTRICT COMMISSION

COMMONWEALTH OF MASSACHUSETTS

BY

METCALF & EDDY, INC.

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF APPENDIX TABLES

LIST OF FIGURES

REPORT

CHAPTER 1

INTRODUCTION

Purpose

The purpose of this technical data volume is to present the inventory and evaluation of the MDC interceptors, pumping stations and headworks in terms of their adequacy to meet projected needs under various concepts and the recommended plan, and to recommend the general upgrading required at the pumping stations and headworks.

Scope

This volume presents the details of the MDC interceptor system, including an updated interceptor map. Preliminary relief sizes and costs of sewers needed under each concept and the recommended plan are presented. For pumping stations and headworks the findings from inspections of each are presented along with preliminary estimates needed for their upgrading to up-to-date standards.

The interceptor system was evaluated through computer modeling of the MDC sewers for purposes of determining their hydraulic adequacy to transport projected flows. This included description of the pipe system in detail along with identification of areas tributary to each pipe through the evaluation of local sewer systems.

In the case of pumping stations and headworks, each major piece of equipment was inventoried. Supervisory and operating personnel were consulted as an aid in ascertaining the work required to rehabilitate each facility. An analysis was then made to determine the modifications required to ensure each facility would meet future capacity requirements by accepted engineering standards.

Report Structure

As shown on the inside cover, the study results are presented in a series of volumes. The criteria used in quantifying the various improvements needed are presented in Technical Data Vol. 1 and 2. The description of the service area configurations used in each concept investigated is presented in Technical Data Vol. 4 and 5. The recommended plan and program for its implementation is presented in Technical Data Vol. 15.

This report is Technical Data Vol. 9, MDC Interceptor and Pumping Station Analysis and Improvements, and covers the evaluation of the adequacy and determination of the needed improvements for the sewers and pumping stations of the MDC. First, this volume describes the existing system; then, interceptor relief requirements are shown and finally, an evaluation of the upgrading requirements for pumping stations and headworks is presented.

Appendixes to this report cover details of the interceptors, pumping stations and headworks facilities. Due to the nature and length of the pumping station and headworks inventories, they have not been included in all copies of the report. However, for those interested in these details, a copy of these inventories is available for review at the Metropolitan District Commission.

CHAPTER 2

EXISTING SYSTEM

General

The MDC sewerage system, called the Metropolitan Sewerage District (MSD), includes treatment plants in Boston Harbor at Deer Island and Nut Island serving respectively the North Metropolitan and South Metropolitan sewerage systems. The MSD includes areas shown on Figure 2-1. Four headworks, 12 pumping stations and interceptors totalling 225 miles presently serve 42 communities including the City of Boston. The MSD has 43 member communities, all of which contribute flow except for Holbrook. Also, the MSD presently operates combined sewer overflow control facilities in Cambridge and Somerville. These, however, are discussed in Technical Data Vol. 7, Combined Sewer Overflow Regulation.

The total area and population served by the MSD is presently 132,800 acres and 1,970,300, respectively.

Figure 2-2 (bound in back) shows the approximate location, size and extent of the existing MDC interceptor system. Shown are the overall size of the various reaches, selected invert elevations (MDC Datum) and the MDC Section Number under which detailed construction records are filed. Details of each pipe are listed in Appendix A.

North Metropolitan Sewerage System

About 68,200 acres and about 1,340,200 persons plus nondomestic contributions are served by the Deer Island Treatment Plant. This includes 22 communities plus parts of Boston, Brookline, Milton and Newton. Table 2-1 summarizes the communities, population and areas served by this system.

A description of the function of various interceptor facilities of this system is presented in Table 2-2. The percentages of communities discharging to the various interceptors shown is on the basis of percent of total area sewered.

Seven of the 12 total MDC pumping stations are in the North Metropolitan System. These are the Alewife Brook, Charlestown, East Boston Electric, East Boston Steam and Reading. The Old Deer Island and Winthrop

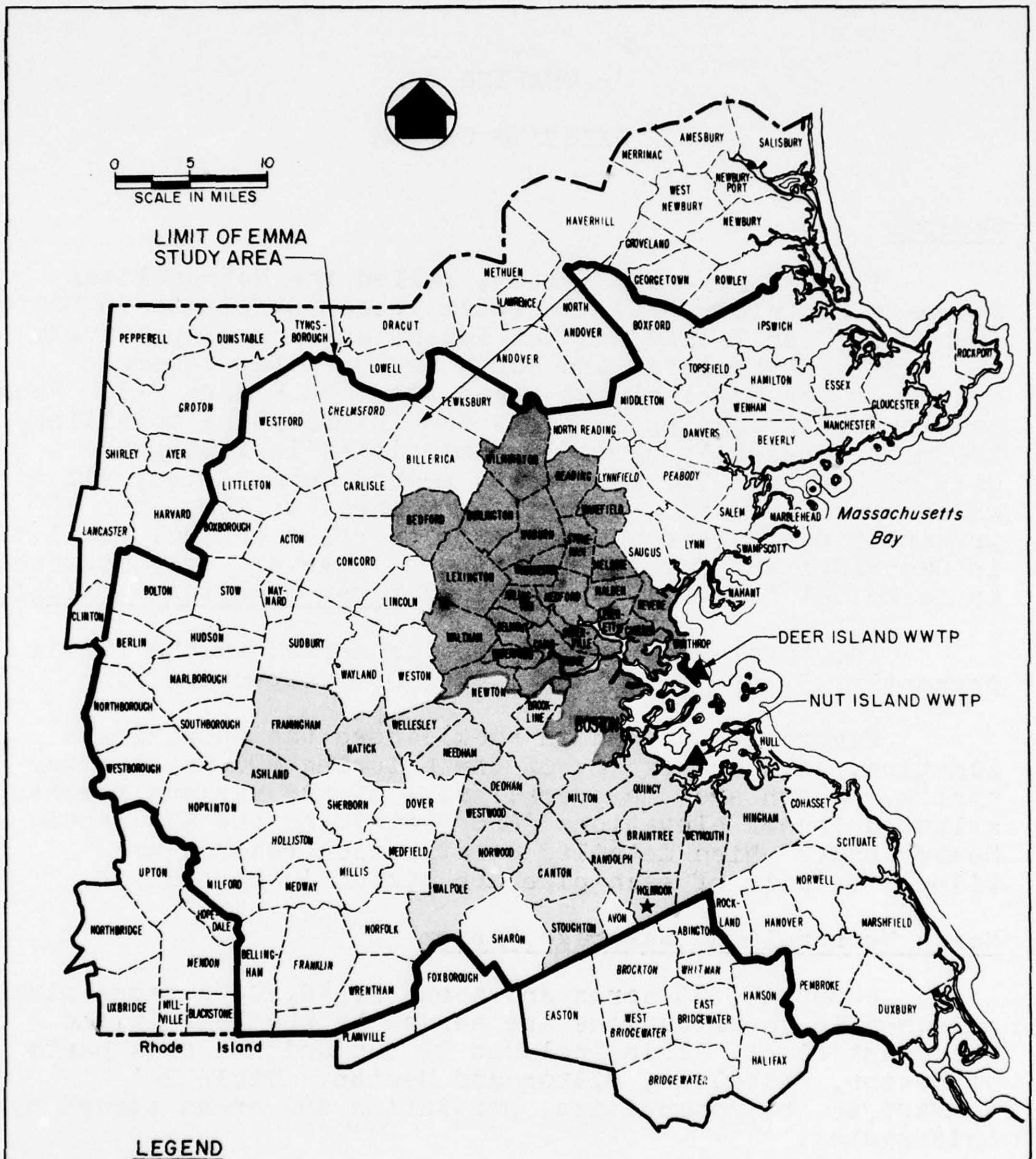

FIG. 2-1 AREAS SERVED BY THE EXISTING METROPOLITAN INTERCEPTOR SYSTEMS AND THE DEER AND NUT ISLAND WASTEWATER TREATMENT PLANTS

TABLE 2-1. EXISTING NORTH METROPOLITAN SEWERAGE SYSTEM (DEER ISLAND) SERVICE AREA

Community Number	Community Name	Sewered population	Sewered acres
2	Arlington	53,600	3,000
5	Bedford	6,100	1,400
7	Belmont	24,400	2,000
15	Brookline (part)	30,700	860
17	Burlington	10,800	3,900
18	Cambridge	100,400	3,400
22	Chelsea	30,600	1,000
30	Everett	42,500	1,300
43	Lexington	24,600	4,400
48	Malden	56,100	2,600
55	Medford	63,800	2,750
57	Melrose	33,200	2,000
61	Milton (part)	4,900	230
66	Newton (part)	41,100	4,120
77	Reading	13,500	2,100
78	Revere	40,600	1,800
86	Somerville	88,700	2,300
88	Stoneham	19,700	1,900
95	Wakefield	22,400	2,250
97	Waltham	46,200	4,300
98	Watertown	39,300	2,100
107	Wilmington	200	50
108	Winchester	22,300	2,550
109	Winthrop	20,300	800
110	Woburn	27,700	2,100
112	Boston Proper -	67,100	1,480
113	Brighton -	63,600	1,990
114	Charlestown -	15,400	480
115	Dorchester -	112,100	2,900
117	East Boston -	38,800	1,120
118	FNWY-JMACA -	38,300	1,290
123	Roxbury -	98,200	2,290
124	South Boston -	43,100	1,470
Total		1,340,200	68,230

TABLE 2-2. DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility[1]	Receives sewage flows from	Discharges sewage flows to
1	Deer Island Treatment Facilities	- Boston Main Drainage Tunnel - North Metropolitan Relief Tunnel - North Metropolitan Sewer below East Boston Pump Station (steam)	- Boston Harbor through outfalls
2	Boston Main Drainage Tunnel	- Ward Street Headworks	- Deer Island Treatment Facilities
3	North Metropolitan Relief Tunnel	- Chelsea Creek Headworks	- Deer Island Treatment Facilities
4	North Metropolitan Sewer below East Boston Pump Station (steam) (Sections 3-1/2, 4 through 9)	- Overflow from Chelsea Creek Headworks via East Boston Steam & East Boston Electric stations - 100 percent of East Boston via East Boston Steam Station - 100 percent of Winthrop	- Deer Island Treatment Facilities
5	Columbus Park Headworks	- 100 percent South Boston via South Boston Interceptor and Boston Main Interceptor - 100 percent of Dorchester (north) via Dorchester Interceptor	- Boston Main Drainage Tunnel

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility[1]	Receives sewage flows from	Discharges sewage flows to
5	Columbus Park Headworks (continued)	- 100 percent of Boston proper via Boston Main Interceptor and East and West Side Interceptors - 100 percent of Fenway-Jamaica (North) and about 60 percent of Roxbury via Boston Main Interceptor and Stony Brook Interceptor	
6	Ward Street Headworks	- South Charles Sewer (Charles River Valley Sewer) - South Charles Relief Sewer - Boston Main Drainage Relief Sewer - About 10 percent of Roxbury	- Boston Main Drainage Tunnel
7	Chelsea Creek Headworks	- Revere Branch Sewer (Sections 61 and 62) - Chelsea Branch Sewer (Sections 11, 56, 57, and 57A) - North Metropolitan Relief Sewer - North Metropolitan Sewer in Chelsea	- North Metropolitan Relief Tunnel - Overflows to East Boston Electric and steam stations via 3-60-in. siphons
8	East Boston Electric Pump Station	- Excess overflow from Chelsea Creek Headworks via 2-60 in. siphons	- North Metropolitan Sewer below East Boston Steam Station - Overflows to Chelsea Creek

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility(1)	Receives sewage flows from	Discharges sewage flows to
9	Chelsea Branch Sewer (Sections 11, 56, 57, and 57A)	- About 25 percent of Chelsea - About 10 percent of Revere - About 5 percent of Everett -	- Chelsea Creek Headworks
10	Revere Branch Sewer (Sections 61 and 62)	- About 90 percent Revere - About 15 percent Chelsea	- Chelsea Creek Headworks
11	North Metropolitan Sewer in Chelsea (Sections 12, 14 through 16, and 23 through 25)	- Cambridge Branch Sewer via Charlestown Pump Station - North Metropolitan Sewer above Cambridge Branch Sewer Intersection (Section 16) - About 30 percent of Everett - About 60 percent of Chelsea	- Chelsea Creek Headworks
12	North Metropolitan Relief Sewer (Sections 102 and 103, 104A, 104B, 105)	- North Metropolitan Relief Sewer above overflow connection from North Metropolitan Sewer (Section 17) - Overflows from North Metropolitan Sewer at Section 17 intersection	- Chelsea Creek Headworks
13	Cambridge Branch Sewer (Sections 25, 25-1/2, 26 through 28)	- Somerville-Medford Branch Sewer - Charlestown Branch Sewer - About 60 percent of Somerville - About 20 percent of Cambridge - About 5 percent of Everett	- Charlestown Pump Station

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility(1)	Receives sewage flows from	Discharges sewage flows to
14	North Metropolitan Sewer above Cambridge Branch Sewer Intersection (Sections 16 and 17)	- North Metropolitan Sewer above Wakefield Trunk Sewer connection - Wakefield Trunk Sewer (Section 40 below Section 95) - About 45 percent of Everett	- North Metropolitan Sewer below Cambridge Branch Sewer connection - Overflows to North Metropolitan Relief Sewer (Section 105)
15	North Metropolitan Sewer above overflow connection from North Metropolitan Sewer (Section 17)	- North Metropolitan Sewer (Section 21) - North Metropolitan Relief Sewer (Section 108) above intersection with North Metropolitan Sewer (Section 21) - Wakefield Branch Relief Sewer (Section 87) - Alewife Brook Conduit (force main)	- North Metropolitan Relief Sewer below overflow connection from Section 17 - Overflows to North Metropolitan Sewer (Section 21)
16	Somerville-Medford Branch Sewer (Section 35)	- About 35 percent of Somerville - About 20 percent of Medford	- Cambridge Branch Sewer - Combined Sewage overflows to Somerville Detention and Chlorination Facility
17	Charlestown Branch Sewer	- 100 percent of Charlestown	- Cambridge Branch Sewer

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility(1)	Receives sewage flows from	Discharges sewage flows to
18	Wakefield Trunk Sewer (Section 40 below Section 95A)	- Malden Relief Sewer (Section 95) - Overflow from Wakefield Branch Relief Sewer (Section 87)	- North Metropolitan Sewer (Section 17)
19	Wakefield Branch Relief Sewer (Section 87, 64, 58, 59, and 60)	- About 80 percent of Wakefield - About 35 percent of Melrose - Malden Relief Sewer (Section 95A)	- North Metropolitan Relief Sewer (Section 105) - Overflow to Wakefield Trunk Sewer (Section 40)
20	Malden Relief Sewer (Section 95)	- About 30 percent of Malden - Overflow from Bryant Street Sewers - Overflow from Malden Branch Sewer (Section 54)	- Wakefield Trunk Sewer (Section 40)
21	Malden Relief Sewer (Section 95A)	- Wakefield Trunk Sewer (Section 40 above section 95A)	- Wakefield Branch Relief Sewer (Section 87)
22	Wakefield Trunk Sewer above Section 95A (Section 41, 49, and 50)	- Malden Branch Sewer (Section 54) - About 65 percent of Melrose - About 20 percent of Wakefield - About 15 percent of Stoneham - About 5 percent of Malden	- Malden Relief Sewer (Section 95A)

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility(1)	Receives sewage flows from	Discharges sewage flows to
23	Malden Branch Sewers (Section 54, 55, 65, and 66)	- About 40 percent of Malden - About 10 percent of Everett	- Wakefield Trunk Sewer above Section 95A - Overflow to Malden Relief Sewer (Section 95) - Intersection with 54 - Overflow to Malden Relief Sewer from Bryant Street Sewers.
24	North Metropolitan Sewer above Wakefield Trunk Sewer (Section 40) connection (Section 17-1/2, 19, 20, and 21)	- Overflows from North Metropolitan Relief Sewer (Section 108) - About 60 percent of Medford - About 20 percent of Malden	- North Metropolitan Sewer (Section 17)
25	Alewife Brook Conduit (force main below pump station)	- Alewife Brook Pump Station	- North Metropolitan Relief Sewer (Section 108)
	Alewife Brook Sewer (Section 43-1/2)	- Excess flow from Alewife Brook Pump Station	- North Metropolitan Sewer (Section 21)
27	Alewife Brook Pump Station	- Lexington Branch Sewer (Section 52) - Alewife Brook Conduit - Alewife Brook Sewer (Section 43)	- Alewife Brook Conduit (force main) - Alewife Brook Sewer (Section 43-1/2) - Overflow to Alewife Brook
28	Alewife Brook Conduit	- Alewife Brook Conduit, Belmont Branch - Belmont Branch Sewer (Section 81)	- Alewife Brook Pump Station

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility(1)	Receives sewage flows from	Discharges sewage flows to
28	Alewife Brook Conduit (continued)	- About 5 percent of Cambridge - Overflows from Alewife Brook Sewer (Section 43)	
29	Alewife Brook Sewer (Section 43)	- About 20 percent of Arlington - About 10 percent of Cambridge - About 5 percent of Somerville	- Alewife Brook Pump Station - Overflows to Alewife Brook Conduit
30	Alewife Brook Conduit Belmont Branch	- About 90 percent of Belmont - About 1 percent of Cambridge	- Alewife Brook Conduit
31	Belmont Branch Sewer (Section 81)	- About 4 percent of Cambridge	- Alewife Brook Conduit
32	North Metropolitan Relief Sewer (Section 108) above intersection with North Metropolitan Sewer (Section 21)	- New Mystic Valley Sewer (Section 109) - Millbrook Valley Sewer (Section 77 via section 22) - North Metropolitan Relief Sewer (Section 111)	- North Metropolitan Relief Sewer (Section 108) below intersection with Section 21 - Overflows to Section 21
33	New Mystic Valley Sewer (Section 67 through 70 and 109)	- Reading Extension Sewer (Section 71) - Overflows from North Metropolitan Sewer (Section 45)	- North Metropolitan Relief Sewer (Section 108) - Overflows from Section 70 to Section 114

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility[1]	Receives sewage flows from	Discharges sewage flows to
33	New Mystic Valley Sewer (continued)	- About 40 percent of Winchester - About 25 percent of Woburn	
34	North Metropolitan Relief Sewer (Section 115A below bypass chamber to 111)	- Millbrook Valley Relief Sewer (Section 91A) - Overflows from New Mystic Valley Sewer (Section 70) - North Metropolitan Sewer (Section 45) - Bypass and Regulator Chamber in Woburn - About 5 percent of Winchester	- North Metropolitan Relief Sewer (Section 108) - Overflows to North Metropolitan Sewer (Section 45) below connection
35	Millbrook Valley Relief Sewer (Sections 93, 92, 91B, and 91A)	- Overflows from Millbrook Valley Sewer (Sections 84, 83, and 80) - Overflows from Lexington Branch Sewer (Sections 53 and 52) - North Metropolitan Sewer (Section 22 above Section 91A) - About 20 percent of Arlington - About 10 percent of Medford	- North Metropolitan Relief Sewer (Section 111)

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility(1)	Receives sewage flows from	Discharges sewage flows to
36	Millbrook Valley Sewer (Section 77 through 80 and 82 through 85)	- Overflow from Lexington Branch Sewer (Sections 53 and 52) - 100 percent of Bedford - About 70 percent of Lexington - About 20 percent of Arlington	- North Metropolitan Relief Sewer (Section 108) via Section 22 - Overflows to Millbrook Valley Relief Sewer
37	Lexington Branch Sewer (Section 52 and 53)	- About 30 percent of Lexington - About 60 percent of Arlington	- Alewife Brook Pump Station - Overflows to Millbrook Valley Sewer - Overflows to Millbrook Valley Relief Sewer
38	North Metropolitan Sewer (Sections 22, 44-1/2, 44 through 46 below bypass chamber)	- Mystic Valley Sewer - Cummingsville Branch Sewer (Section 47) - Overflows from Cummingsville Branch Relief Sewer (Section 86) - Overflows from North Metropolitan Relief Sewer (Section 114) - Bypass & Regulator Chamber (Section 115A) - About 30 percent of Winchester - About 5 percent of Medford	- Millbrook Valley Relief Sewer (Section 91A) - All flows to North Metropolitan Relief Sewer (Section 114) from Section 45 - Overflows to New Mystic Valley Sewer (Section 70)

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility[1]	Receives sewage flows from	Discharges sewage flows to
39	Mystic Valley Sewer	- About 5 percent of Winchester - About 5 percent of Woburn	- North Metropolitan Relief Sewer (Section 22)
40	Cumminsville Branch Sewer (Section 47)	- About 10 percent of Winchester - About 10 percent of Woburn	- North Metropolitan Sewer (Section 44) - Overflows to Mystic Valley Sewer
41	Cumminsville Branch Relief Sewer (Section 86)	- 100 percent of Burlington - About 5 percent of Winchester - About 30 percent of Woburn	- North Metropolitan Relief Sewer (Section 114) - Overflows to North Metropolitan Sewer (Section 44)
42	Reading Extension Sewer (Section 71 and 72 below bypass chamber)	- Bypass and regulator chamber (Section 115A) - About 5 percent of Winchester	- New Mystic Valley Sewer (Section 69)
43	Wilmington Extension Sewer (Section 88 & 89)	- 100 percent of Wilmington - About 10 percent of Woburn	- Bypass and regulator chamber (Section 115A)
44	Bypass chamber (Section 115A)	- North Metropolitan Sewer (Section 46) - North Metropolitan Relief Sewer (Section 115A) - Reading Extension Sewer (Section 72) - Wilmington Extension Sewer (Section 88)	- North Metropolitan Sewer (Section 46 below bypass chamber) - North Metropolitan Relief Sewer (Section 115A below bypass chamber) - Reading Extension Sewer (Section 72 below bypass chamber)

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility(1)	Receives sewage flows from	Discharges sewage flows to
45	Reading Extension Sewer (Section 72 above bypass chamber to 76)	- 100 percent of Reading - About 30 percent of Stoneham - About 10 percent of Wakefield	- Bypass chamber in Woburn (Section 115A) - Overflows to North Metropolitan Relief Sewer (Section 115B) - Overflow to North Metropolitan Sewer (Section 46)
46	North Metropolitan Relief Sewer (Sections 115B and 115A above bypass chamber)	- Overflows from Reading Extension Sewer (Section 75) - About 30 percent of Stoneham - About 15 percent of Woburn	- Bypass chamber (Section 115A)
47	North Metropolitan Sewer (Section 46 above bypass chamber)	- Overflows from Reading Extension Sewer (Section 73) - About 25 percent of Stoneham - About 5 percent of Woburn	- Bypass chamber (Section 115A)
48	South Charles Relief Sewer below Charles River crossing (Sections 5 and CRC)	- North Charles Relief Sewer - South Charles Relief Sewer above Charles River crossing - Overflows from South Charles Sewer below Charles River crossing	- Ward Street Headworks
49	South Charles Relief Sewer above Charles River crossing (Sections 1 through 4)	- Overflows from South Charles Sewer - About 60 percent of Watertown	- South Charles Relief Sewer below Charles River crossing - Combined sewage overflows to BU detention and chlorination facility

TABLE 2-2 (Continued). DESCRIPTION OF NORTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility[1]	Receives sewage flows from	Discharges sewage flows to
50	South Charles Sewer (Charles River Valley Sewer) (Sections A through H and 4A)	- 100 percent of Waltham - 100 percent of Newton (north) - 100 percent of Brighton - 100 percent of Brookline (north) - About 40 percent of Watertown - About 20 percent of Roxbury	- Ward Street Headworks - Overflows to South Charles Relief Sewer - Combined sewage overflows to BU detention and chlorination facility via 54 in. Charles River Crossing
51	North Charles Relief Sewer (Sections 207A and 207b)	- All flows and overflows from North Charles Metropolitan Sewer	- South Charles Relief Sewer below Charles River crossing - Combined sewage overflows to BU chlorination and detention facility
52	North Charles Metropolitan Sewer (Sections 209, 29 and 30, and 63)	- About 60 percent of Cambridge - About 10 percent of Belmont	- North Charles Relief Sewer at BU facility - Overflows to North Charles Relief Sewer
53	Boston Main Interceptor	- 100 percent of Boston proper via East and West Side Interceptors[2] - 100 percent of Fenway-Jamaica and about 60 percent of Roxbury via Stony Brook Interceptor.[2]	- Columbus Park Headworks - Overflows to Ward Street Headworks via Boston Main Drainage Relief.

1. For location see Figure 2-2.
2. City of Boston Interceptors.

pumping stations are in existence but are no longer in active use. The Deer Island Pumping Station is being phased out of the system now that flows are being diverted directly to the Winthrop Terminal Facility. Flows tributary to the Winthrop Pumping Station now enter the MDC North Metropolitan Sewer by gravity since most of the flows tributary to this sewer have been diverted to the North Metropolitan Relief Tunnel.

All four headworks, namely Chelsea Creek, Columbus Park, Ward Street and Winthrop Terminal Facility are also part of the North Metropolitan Sewerage System.

South Metropolitan Sewerage System

An estimated 64,600 acres are sewered in the area tributary to this system serving about 630,200 persons, plus nonresidential contributors.

Wastewater from 16 communities plus parts of Boston, Brookline, Milton and Newton flows to the Nut Island Treatment Plant as shown in Table 2-3.

The interrelationship and function of the South Metropolitan System interceptors is shown in Table 2-4.

The remaining five pumping stations of the MSD are the Braintree-Weymouth, Hingham, Quincy, Houghs Neck and Squantum pumping stations.

TABLE 2-3. EXISTING SOUTH METROPOLITAN SEWERAGE SYSTEM (NUT ISLAND) SERVICE AREA

Community Number	Community Name	Sewered population	Sewered acres
3	Ashland	1,100	250
14	Braintree	34,400	4,400
16	Brookline (part)	27,500	2,330
19	Canton	8,900	1,650
26	Dedham	23,800	2,700
31	Framingham	50,600	7,000
36	Hingham	3,800	650
37	Holbrook(1)	0	0
62	Milton (part)	20,700	2,510
64	Natick	21,400	3,800
65	Needham	25,500	3,600
67	Newton (part)	50,000	6,260
72	Norwood	30,500	3,200
75	Quincy	88,000	5,250
76	Randolph	13,500	1,800
89	Stoughton	5,600	1,000
96	Walpole	5,800	1,100
100	Wellesley	22,700	6,200
105	Westwood	4,300	600
106	Weymouth	27,800	3,050
	Boston		
116	Dorchester	25,700	410
119	FNWY-JMACA	10,000	490
120	Hyde Park	38,300	2,660
121	Mattapan(2)	37,200	960
122	Roslindale(2)	28,200	1,300
125	West Roxbury	25,000	1,450
Total		630,200	64,620

1. Presently not served by the MDC.
2. Negligible areas of Mattapan and Roslindale that contribute to the Deer Island Treatment Plant are considered tributary to the Nut Island Treatment Plant.

TABLE 2-4. DESCRIPTION OF SOUTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility	Receives sewage flows from	Discharges sewage flows to
1	Nut Island Treatment Plant	- High level sewer	- Ocean through outfalls
2	High level sewer (Sections 45 through 75)	- Houghs Neck Pump Station - Braintree-Weymouth Pump Station - Squantum Pump Station - New Neponset Valley sewer - Neponset Valley sewer - Wellesley extension relief sewer - Brighton Branch sewer - 100 percent of Mattapan (south) - 100 percent of Dorchester (south) - 100 percent of Fenway-Jamaica (south) - Approximately 90 percent of Roslindale (south) - Approximately 20 percent of Hyde Park - Approximately 15 percent of West Roxbury - Approximately 13 percent of Quincy - Approximately 70 percent of Milton (south)	- Nut Island Treatment Plant

TABLE 2-4 (Continued). DESCRIPTION OF SOUTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility	Receives sewage flows from	Discharges sewage flows to
3	Braintree-Weymouth extension sewer (Sections 122 through 125)	- Hingham Pump Station - Braintree-Randolph extension sewer - 100 percent of Weymouth - 70 percent of Braintree - About 15 percent of Quincy	- Braintree-Weymouth Pump Station
4	Braintree-Randolph extension sewer (Sections 126 through 128 and 128A)	- 100 percent of Randolph - About 30 percent of Braintree	- Braintree-Weymouth extension sewer
5	New Neponset Valley sewer (Sections 107 through 115)	- Walpole extension sewer - Stoughton extension sewer - Westwood extension sewer - About 10 percent of Dedham - About 30 percent of Milton (south) - About 5 percent of Hyde Park - About 40 percent of Canton	- High level sewer
6	Westwood extension sewer (Sections 135 and 136)	- 100 percent of Westwood - About 10 percent of Norwood	- New Neponset Valley sewer
7	Walpole extension sewer (Sections 116, 117, and 118)	- 100 percent of Walpole - About 90 percent of Norwood	- New Neponset Valley sewer

TABLE 2-4 (Continued). DESCRIPTION OF SOUTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility	Receives sewage flows from	Discharges sewage flows to
8	Stoughton extension sewer (Sections 119 through 121)	- 100 percent of Stoughton - About 60 percent of Canton	- New Neponset Valley sewer
9	Neponset Valley sewer (Sections 15 through 26)	- Wellesley extension sewer - Upper Neponset Valley sewer - Approximately 50 percent of Dedham - Approximately 75 percent of Hyde Park - Approximately 15 percent of West Roxbury	- High level sewer
10	Wellesley extension relief sewer (Sections 138, and 129 through 131)	- Framingham extension sewer - Overflow from Wellesley extension sewer - Overflow from Upper Neponset Valley sewer	- High level sewer
11	Brighton Branch sewer (Sections 80 through 87)	- Approximately 75 percent of Brookline (south) - Approximately 86 percent of Newton (south)	- High level sewer
12	Framingham extension sewer (Sections 132, 133B, and 134)	- 100 percent of Ashland - 100 percent of Framingham - 100 percent of Natick - Overflow from Wellesley connection (Section 106)	- Wellesley extension relief sewer

TABLE 2-4 (Continued). DESCRIPTION OF SOUTH METROPOLITAN SEWERAGE SYSTEM

No.	Sewerage facility	Receives sewage flows from	Discharges sewage flows to
13	Wellesley extension sewer (Sections 98 through 106)	- 100 percent of Wellesley - 100 percent of Needham - Approximately 40 percent of Dedham	- Overflow to Framingham extension at Wellesley connection - Overflow to Wellesley extension relief sewer - Neponset Valley sewer
14	Upper Neponset Valley sewer (Section 27 through 30)	- Approximately 25 percent of Brookline (south) - Approximately 14 percent of Newton (south) - Approximately 70 percent of West Roxbury - Approximately 10 percent of Roslindale (south)	- Neponset Valley sewer - Overflow to Wellesley extension relief sewer
15	Houghs Neck Pump Station and force main	- Approximately 2 percent of Quincy	- High level sewer
16	Braintree-Weymouth Pump Station and force main	- Braintree-Weymouth extension sewer	- High level sewer
17	Squantum Pump Station and force main	- Approximately 10 percent of Quincy	- High level sewer
18	Hingham Pump Station and force main	- 100 percent of Hingham	- Braintree-Weymouth extension sewer
19	Quincy Pump Station and force mains	- Approximately 60 percent of Quincy	- High level sewer

CHAPTER 3

EVALUATION PROCEDURE

General

In the past, the procedure in sizing interceptors and pumping stations has been to design on the basis of peak dry weather flows, plus an allowance for stormwater inflow, where combined sewers were tributary to the interceptor under design. In the latter case, various criteria were used, but generally a factor of three times average dry weather flow was employed as the basis for design.

Since this procedure is no longer acceptable to achieving water pollution control for combined sewers, other means for controlling combined sewer overflows have been evaluated apart from intercepting additional flows. On this basis, the adequacy of interceptors and pumping stations is measured on the basis of peak dry weather flow capacity with combined sewer overflows being evaluated explicitly for remedial action in Technical Data Vol. 7.

Interceptors

The hydraulic capacity and relief requirements of the interceptors was determined through computer modeling.

The model carries out hydraulic gradient calculations and consists of an Executive Block, two Main Programs (one for Subcritical Flows and the other for Supercritical Flows in the system), and a number of subprograms for computational support for the main programs. Each subprogram is written to do some computational functions. As for example, there are subprograms to calculate flow properties and head losses in conduits, bends, transitions, siphons, etc.

The model identifies each sewer element separately, calculates critical slope, normal depth and full flow capacity, and the hydraulic and energy gradients under the modeled flow condition. A description of the model used is presented in Appendix B.

In preparing the model of the MDC Interceptors, the physical properties of each section of the interceptor system were collected by going through MDC files and construction drawings. All information regarding how the

various interceptors are connected was also collected. Any modifications to the interceptor system that were made after they were built were also included. An updated interceptor data base and map was prepared showing all present interceptors and the communities that presently contribute sewage flows to the system.

Following completion of the interceptor map, the next step was to determine the quantity of average and peak sewage flows that each section of the interceptor system needs to carry.

This was done by first identifying how sewage from each community flows into the MDC interceptor system. This led to the identification of tributary areas for each interceptor in the system as shown in Tables 2-2 and 2-4. Average and peak flows in each interceptor were then calculated based on the areas contributing to that section, population served, and major and minor industrial flows (see Technical Data Vol. 2, Engineering Criteria). Once flows in each sewer section were estimated, modeling started at the downstream terminal point in the interceptor. Hydraulic analysis then proceeded in an upstream direction. Appendix C presents the program instructions for the interceptor analysis while Appendix D presents an example of how this interceptor modeling was conducted including inputs to the model and results from using the model.

Analysis of the interceptor system was initially done using estimated peak present design flows. In this analysis, the model output provided capacities for each interceptor and pinpointed all sections requiring immediate relief. During the modeling of the interceptor system, it was noted that many of the interceptor shapes were other than circular or prismatic, such as horse-shoe, egg, etc. There appeared to be no standard depth to width ratio. Accordingly, these sections were converted to equivalent circular sections in the model.

Interceptor adequacy was tested against 1970, 1980, 2000, 2020 and 2050 design flows. Wherever the 1970 or 1980 flows showed lack of adequate capacity, need for immediate relief was identified and sized on the basis of year 2020 design flows. Where such were found to be adequate for the year 2000 flows, relief was sized to meet year 2050 needs and was indicated as requiring future relief.

Pumping Stations and Headworks

In this investigation peak dry weather flows estimated to occur by the year 2000 were used to ascertain

the capacity required to meet future needs. A design period of 20 years was used for pumping stations and headwork facilities which if properly designed are easily expanded.

It should be noted that the future capacity requirements are based on projected dry weather flows, and do not provide for excessive inflows into the sewerage systems. Since inflows do occur, detailed investigations will be required to determine if areas of storm inflow can be isolated, and inflows effectively reduced. If substantial corrections cannot be made, then it will be necessary to increase the pumping capacity accordingly.

Particular effort was made to ascertain those modifications that would be required so that each facility would conform to sound and accepted engineering standards. Attention was given to the age, type and condition of the installed equipment in each facility in determining the continued use of such equipment to provide for future needs.

In order to achieve this, field inspection of each major facility was conducted and an inventory of each major piece of equipment was made and is presented in Appendixes F and G.

In all cases, it has been assumed and recommended that all pumping stations will be electrified, and designed for at least automatic local control of the pumping operations in accordance with the level of wastewater in the wet well.

Present day standards require that wastewater pumping stations have sufficient pumping capacity to handle peak incoming flows with the largest pumping unit out of service. Accordingly, it will be necessary to increase the capacity of the pumping equipment in all of these stations that serve separate sewer systems with the possible exception of Quincy which has adequate capacity. However, in the case of Quincy, due to the age of the equipment, the drive and pumping units should be replaced.

CHAPTER 4

SEWER RELIEF REQUIREMENTS UNDER SERVICE AREA CONCEPTS STUDIED

General

Five alternative basic concepts are considered in this study for the collection and disposal of sewage flows from the Eastern Massachusetts Metropolitan Area. The sewer relief requirements under the fifth concept are identical to those in Concept 4, consequently, required changes to the existing MSD system as presented for Concept 4 below, also apply to Concept 5. Detailed descriptions of each concept are given in Technical Data Volumes 4 (Concepts 1 through 4) and 5 (Concept 5). For comparison of areas to be served in the year 2000 with the present service areas see Tables 2-1 and 2-3.

Concept 1

This concept is visualized as a regional plan to upgrade the existing MSD service area. This increases the areas served by the Deer and Nut Island treatment plants to the following:

Deer Island service area	From 68,200 to 87,600 sewered acres
Nut Island service area	From 64,600 to 99,300 sewered acres

Addition of the towns of Lincoln, Lynnfield and Weston to the existing North System and Dover, Hopkinton, Sharon and Sherborn to the existing South System are included in this plan. The interceptors that require relief under this concept are illustrated on Figure 4-1 (bound in back). Table 4-1 lists the interceptors (in groupings by section number) requiring relief, the year relief is required and the lengths and sizes of these relief sewers.

Concept 2

Concept 2 is visualized as a regional plan with some contraction of the existing Deer Island and Nut Island service areas to the following:

Deer Island service area	From 68,200 to 72,700 sewered acres
Nut Island service area	From 64,600 to 37,100 sewered acres

TABLE 4-1. MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 1

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
1	Millbrook Valley Sewer				
	- Section 84	Now	42	1,060	North
	- Section 85	Now	42	11,680	North
2	Wilmington Extension Sewer				
	- Section 89 (Portion)	2000	36	870	North
	- Section 90	2000	36	8,660	North
3	Reading Extension Sewer				
	- Section 76 (Portion)	Now	42	1,360	North
	- Section 76 (Portion)	Now	24 (FM)[1]	1,350	North
	- Section 75 (Portion)	Now	30	5,460	North
	- Section 72 (Portion)	2000	27	3,000	North
	- Section 71 (Portion)	2000	30	2,000	North
	- Section 71 (Portion)	2000	36	1,000	North
4	North Metropolitan Sewer				
	- Section 44-1/2 (Portion)	2000	60	2,000	North
	- Section 17 (Portion)	Now	60	2,600	North
5	North Metropolitan Relief Sewer				
	- Section 111 (Portion)	2000	54	2,000	North
6	Chelsea Branch Sewer				
	- Section 57 (Portion)	Now	21	1,140	North
7	Stoneham Extension Sewer				
	- Section 51 (Portion)	Now	8[2]	1,000	North
	- Section 51 (Portion)	Now	10[2]	3,130	North

TABLE 4-1 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 1

Group No.	Interceptor requring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
8	Stoneham Trunk Sewer				
	- Section 42	Now	18	3,050	North
9	Wakefield Branch Sewer				
	- Section 50 (Portion)	2000	15	3,090	North
	- Section 50 (Portion)	Now	42	1,580	North
	- Section 49	Now	36	3,880	North
10	Wakefield Trunk Sewer				
	- Section 41 (Portion)	2000	54	3,040	North
	- Section 41 (Portion)	2000	48	2,700	North
	- Section 40	2000	48	6,235	North
11	North Charles Metropolitan Sewer				
	- Section 63 (Portion)	Now	24	1,310	North
	- Section 63 (Portion)	Now	30	1,400	North
	- Section 63 (Portion)	Now	36	3,100	North
12	South Charles Relief Sewer				
	- Section 4A (Portion)	Now	36	5,120	North
	- Section 4A (Portion)	Now	48	3,840	North

TABLE 4-1 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 1

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
13	South Charles Sewer				
	- Section H (Portion)	Now	48	1,440	North
	- Section H (Portion)	2000	30	3,040	North
	- Section G	2000	30	2,800	North
	- Section F	2000	36	2,090	North
14	South Charles Relief Sewer				
	- Section 5 (Portion)	Now	60	2,300	North
	- Section 5 (Portion)	Now	72	5,510	North
15	Charles River Crossing				
	- Section 204	Now	78	600	North
16	Cross-Connection Between South Charles Sewer to South Charles Relief Sewer	Now	36	700	North
17	High Level Sewer				
	- Section 45	2000	114	970	South
	- Section 46	2000	114	790	South
	- Section 47	2000	114	3,160	South
	- Section 48 (Portion)	2000	114	4,000	South

TABLE 4-1 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 1

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
18	Upper Neponset Valley Sewer				
	- Section 26 (Portion)	Now	30	1,860	South
	- Section 27	Now	30	3,460	South
	- Section 28	Now	30	4,570	South
	- Section 29 (Portion)	Now	30	450	South
	- Section 29 (Portion)	Now	24	4,250	South
	- Section 30	Now	24	6,720	South
19	New Neponset Valley Sewer				
	- Section 107	2000	78	3,570	South
	- Section 108	2000	78	3,780	South
	- Section 109	2000	78	4,450	South
	- Section 110	2000	72	3,180	South
	- Section 111	Now	84	5,600	South
	- Section 112	Now	84	5,600	South
	- Section 113 (Portion)	Now	84	4,670	South
	- Section 113 (Portion)	Now	78	630	South
	- Section 114	Now	78	5,800	South
	- Section 115 (Portion)	Now	78	4,330	South
	- Section 115 (Portion)	Now	54	1,705	South

TABLE 4-1 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 1

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
20	Stoughton Extension Sewer				
	- Section 119 (Portion)	Now	54	3,220	South
	- Section 119 (Portion)	2000	36	40	South
	- Section 120	2000	36	3,300	South
	- Section 121 (Portion)	2000	24	1,550	South
	- Section 121 (Portion)	Now	36	1,660	South
	- Section 121 (Portion)	Now	30	2,270	South
21	Walpole Extension Sewer				
	- Section 116 (Portion)	Now	60	800	South
	- Section 116 (Portion)	Now	54	4,400	South
	- Section 117	Now	54	5,740	South
	- Section 118	Now	48	4,930	South
22	Westwood Extension Sewer				
	- Section 135	2000	30	5,610	South
	- Section 136	2000	30	6,700	South
23	Braintree-Weymouth Extension Sewer				
	- Section 122	Now	60	5,530	South
	- Section 123	Now	60	1,626	South
	- Section 124	Now	60	3,082	South
	- Section 125 (Portion)	Now	60	2,878	South
	- Section 125 (Portion)	Now	27	744	South
	- Hingham Force Main	Now	24	7,600	South

TABLE 4-1 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 1

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
24	Wellesley Extension Sewer				
	- Section 98	Now	72	3,350	South
	- Section 99	Now	66	3,300	South
	- Section 100	Now	66	3,920	South
	- Section 101 (Portion)	Now	66	2,420	South
	- Section 101 (Portion)	Now	72	1,420	South
	- Section 102	Now	72	6,850	South
	- Section 103	Now	72	5,920	South
	- Section 104	Now	72	4,300	South
	- Section 105	Now	72	4,425	South
	- Section 106	Now	72	4,350	South
25	Framingham Extension Sewer				
	- Section 132	Now	66	10,500	South
	- Section 133 B (Portion)	Now	66	11,090	South
	- Section 133 B (Portion)	Now	60	2,000	South
	- Section 134	Now	60	8,175	South

1. Force main.
2. Minimum recommended relief size is 12 inches.

In Concept 2, Lincoln, Lynnfield and Weston would be added to the MSD system but sewage flows from Lincoln and Weston would not flow to Deer Island. Instead sewage from Lincoln, Weston, Waltham, Watertown and part of Newton would be treated at a proposed treatment plant in the Watertown area. In the South Metropolitan System, Sherborn and Dover would be added but sewage flows would be treated at a proposed treatment plant on the Charles River together with flows from Natick, Wellesley, Needham and part of Dedham. Sharon would be added to the South System but sewage flows from Sharon would be treated at one of two proposed treatment plants in the Canton area along with sewage from Walpole, Stoughton and parts of Norwood and Canton. Figure 4-1 (bound in back) illustrates the relief requirements under Concept 2. Table 4-2 lists the interceptors requiring relief, year relief required and lengths and sizes of the relief sewers.

Concept 3

Concept 3 is a regional plan with maximum possible expansion of the MSD system. This increases the areas served by the Deer and Nut Island plants to the following:

Deer Island service area	From 68,200 to 87,600 sewered acres
Nut Island service area	From 64,600 to 111,400 sewered acres

In this concept, Lincoln, Lynnfield and Weston would be added to the North Metropolitan System. In the south, Southborough, Hopkinton, Holliston, Sherborn, Dover, Medfield, Millis, Medway, Milford, Norfolk, Franklin, Wrentham, Sharon and part of Bellingham would be added. Figure 4-1 illustrates the extent of relief required in this concept for the existing North and South Systems. Table 4-3 lists the interceptors requiring relief, year relief required and the sizes and lengths of relief sewers.

Concept 4

Concept 4 is a regional plan with maximum decentralization of the existing MSD system by construction of additional upstream treatment plants within present service areas. This reduces the area served by the existing system at the Deer and Nut Island plants to the following:

Deer Island service area	From 68,200 to 36,300 sewered acres

TABLE 4-2. MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 2

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
1	Millbrook Valley Sewer				
	- Section 84	Now	42	1,060	North
	- Section 85	Now	42	11,680	North
2	Wilmington Extension Sewer				
	- Section 89 (Portion)	2000	36	870	North
	- Section 90	2000	36	8,660	North
3	Reading Extension Sewer				
	- Section 76 (Portion)	Now	42	1,360	North
	- Section 76 (Portion)	Now	24(FM)(1)	1,350	North
	- Section 75 (Portion)	Now	30	5,460	North
	- Section 72 (Portion)	2000	27	3,000	North
	- Section 71 (Portion)	2000	30	2,000	North
	- Section 71 (Portion)	2000	36	1,000	North
4	North Metropolitan Sewer				
	- Section 44-1/2 (Portion)	2000	60	2,000	North
	- Section 17 (Portion)	Now	60	2,600	North
5	North Metropolitan Relief Sewer				
	- Section 111 (Portion)	2000	54	2,000	North
6	Chelsea Branch Sewer				
	- Section 57 (Portion)	Now	21	1,140	North

TABLE 4-2 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 2

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
7	Stoneham Extension Sewer				
	- Section 51 (Portion)	Now	8(2)	1,000	North
	- Section 51 (Portion)	Now	10(2)	3,130	North
8	Stoneham Trunk Sewer				
	- Section 42	Now	18	3,050	North
9	Wakefield Branch Sewer				
	- Section 50 (Portion)	2000	15	3,090	North
	- Section 50 (Portion)	Now	42	1,580	North
	- Section 49	Now	36	3,880	North
10	Wakefield Trunk Sewer				
	- Section 41 (Portion)	2000	54	3,040	North
	- Section 41 (Portion)	2000	48	2,700	North
	- Section 40	2000	48	6,235	North
11	North Charles Metropolitan Sewer				
	- Section 63 (Portion)	Now	24	1,310	North
	- Section 63 (Portion)	Now	30	1,400	North
	- Section 63 (Portion)	Now	36	3,100	North
12	South Charles Relief Sewer				
	- Section 4A (Portion)	Now	36	5,120	North
	- Section 4A (Portion)	Now	48	3,840	North

TABLE 4-2 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 2

Group No.	Interceptor requiring relief	Year relief Required	Relief sewer size, in.	Length, ft.	System
13	South Charles Sewer				
	- Section H (Portion)	Now	48	1,440	North
	- Section H (Portion)	2000	30	3,040	North
	- Section G	2000	30	2,800	North
	- Section F	2000	36	2,090	North
18	Upper Neponset Valley Sewer				
	- Section 26 (Portion)	Now	30	1,860	South
	- Section 27	Now	30	3,460	South
	- Section 28	Now	30	4,570	South
	- Section 29 (Portion)	Now	30	450	South
	- Section 29 (Portion)	Now	24	4,250	South
	- Section 30	Now	24	6,720	South
19	New Neponset Valley Sewer				
	- Section 115 (Portion)	Now	54	1,705	South
20	Stoughton Extension Sewer				
	-Section 119 (Portion)	Now	54	3,220	South
	-Section 119 (Portion)	2000	36	40	South
	-Section 120	2000	36	3,300	South
	-Section 121 (Portion)	2000	24	1,550	South
	-Section 121 (Portion)	Now	36	1,660	South
	-Section 121 (Portion)	Now	30	2,270	South

TABLE 4-2 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 2

Group No.	Interceptor relief required	Year relief required	Relief sewer size, in.	Length, ft.	System
21	Walpole Extension Sewer				
	- Section 116 (Portion)	Now	60	800	South
	- Section 116 (Portion)	Now	54	4,400	South
	- Section 117	Now	54	5,740	South
	- Section 118	Now	48	4,930	South
22	Westwood Extension Sewer				
	- Section 135	2000	30	5,610	South
	- Section 136	2000	30	6,700	South
23	Braintree-Weymouth Extension Sewer				
	- Section 122	Now	60	5,530	South
	- Section 123	Now	60	1,626	South
	- Section 124	Now	60	3,082	South
	- Section 125 (Portion)	Now	60	2,878	South
	- Section 125 (Portion)	Now	27	744	South
	- Hingham Force Main	Now	24	7,600	South
24	Wellesley Extension Sewer				
	- Section 102	2000	48	6,850	South
	- Section 103	2000	48	5,920	South
	- Section 104	2000	48	4,300	South
	- Section 105	2000	48	4,425	South
	- Section 106	2000	48	4,350	South

1. Force main.
2. Minimum recommended relief size is 12 inches.

TABLE 4-3. MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 3

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
1	Millbrook Valley Sewer				
	- Section 84	Now	42	1,060	North
	- Section 85	Now	42	11,680	North
2	Wilmington Extension Sewer				
	- Section 89 (Portion)	2000	36	870	North
	- Section 90	2000	36	8,660	North
3	Reading Extension Sewer				
	- Section 76 (Portion)	Now	42	1,360	North
	- Section 76 (Portion)	Now	24 (FM)(1)	1,350	North
	- Section 75 (Portion)	Now	30	5,460	North
	- Section 72 (Portion)	2000	27	3,000	North
	- Section 71 (Portion)	2000	30	2,000	North
	- Section 71 (Portion)	2000	36	1,000	North
4	North Metropolitan Sewer				
	- Section 44-1/2 (Portion)	2000	60	2,000	North
	- Section 17 (Portion)	Now	60	2,600	North
5	North Metropolitan Relief Sewer				
	- Section 111 (Portion)	2000	54	2,000	North
6	Chelsea Branch Sewer				
	- Section 57 (Portion)	Now	21	1,140	North

TABLE 4-3 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 3

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
7	Stoneham Extension Sewer				
	- Section 51 (Portion)	Now	8[2]	1,000	North
	- Section 51 (Portion)	Now	10[2]	3,130	North
8	Stoneham Trunk Sewer				
	- Section 42	Now	18	3,050	North
9	Wakefield Branch Sewer				
	- Section 50 (Portion)	2000	15	3,090	North
	- Section 50 (Portion)	Now	42	1,580	North
	- Section 49	Now	36	3,880	North
10	Wakefield Trunk Sewer				
	- Section 41 (Portion)	2000	54	3,040	North
	- Section 41 (Portion)	2000	48	2,700	North
	- Section 40	2000	48	6,235	North
11	North Charles Metropolitan Sewer				
	- Section 63 (Portion)	Now	24	1,310	North
	- Section 63 (Portion)	Now	30	1,400	North
	- Section 63 (Portion)	Now	36	3,100	North
12	South Charles Relief Sewer				
	- Section 4A (Portion)	Now	36	5,120	North
	- Section 4A (Portion)	Now	48	3,840	North

TABLE 4-3 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 3

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
13	South Charles Sewer				
	- Section H (Portion)	Now	48	1,440	North
	- Section H (Portion)	2000	30	3,040	North
	- Section G	2000	30	2,800	North
	- Section F	2000	36	2,090	North
14	South Charles Relief Sewer				
	- Section 5 (Portion)	Now	60	2,300	North
	- Section 5 (Portion)	Now	72	5,510	North
15	Charles River Crossing				
	- Section 204	Now	78	600	North
16	Cross-Connection Between South Charles Sewer to South Charles Relief Sewer	Now	36	700	North

TABLE 4-3 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 3

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
17	High Level Sewer				
	- Section 45	2000	138	970	South
	- Section 46	2000	138	790	South
	- Section 47	2000	126	3,160	South
	- Section 48 (Portion)	2000	126	4,000	South
	- Section 48 (Portion)	2000	114	1,880	South
	- Section 49	2000	114	3,500	South
	- Section 50	2000	114	3,040	South
	- Section 51	2000	114	2,365	South
	- Section 52	2000	114	2,775	South
	- Section 53	2000	114	1,900	South
	- Section 54	2000	114	1,990	South
	- Section 55	2000	114	3,540	South
	- Section 56	2000	114	1,500	South
	- Section 57	2000	114	1,870	South
	- Section 58	2000	114	2,540	South
	- Section 59	2000	114	2,570	South
	- Section 60	2000	114	1,610	South
	- Section 61	2000	114	2,800	South
18	Upper Neponset Valley Sewer				
	- Section 26 (Portion)	Now	30	1,860	South
	- Sectonn 27	Now	30	3,460	South
	- Section 28	Now	30	4,570	South
	- Section 29 (Portion)	Now	30	450	South
	- Section 29 (Portion)	Now	24	4,250	South
	- Section 30	Now	24	6,720	South

TABLE 4-3 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 3

Group No.	Interceptor requiring rclief	Year relief required	Relief sewer size, in.	Length, ft.	System
19	New Neponset Valley Sewer				
	- Section 107	2000	78	3,570	South
	- Section 108	2000	78	3,780	South
	- Section 109	2000	78	4,450	South
	- Section 110	2000	72	3,180	South
	- Section 111	Now	84	5,600	South
	- Section 112	Now	84	5,600	South
	- Section 113 (Portion)	Now	84	4,670	South
	- Section 113 (Portion)	Now	78	630	South
	- Section 114	Now	78	5,800	South
	- Section 115 (Portion)	Now	78	4,330	South
	- Section 115 (Portion)	Now	54	1,705	South
20	Stoughton Extension Sewer				
	- Section 119 (Portion)	Now	54	3,220	South
	- Section 119 (Portion)	2000	36	40	South
	- Section 120	2000	36	3,300	South
	- Section 121 (Portion)	2000	24	1,550	South
	- Section 121 (Portion)	Now	36	1,660	South
	- Section 121 (Portion)	Now	30	2,270	South
21	Walpole Extension Sewer				
	- Section 116 (Portion)	Now	60	800	South
	- Section 116 (Portion)	Now	54	4,400	South
	- Section 117	Now	54	5,740	South
	- Section 118	Now	48	4,930	South

TABLE 4-3 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 3

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
22	Westwood Extension Sewer				
	- Section 135	2000	30	5,610	South
	- Section 136	2000	30	6,700	South
23	Braintree-Weymouth Extension Sewer				
	- Section 122	Now	60	5,530	South
	- Section 123	Now	60	1,626	South
	- Section 124	Now	60	3,082	South
	- Section 125 (Portion)	Now	60	2,878	South
	- Section 125 (Portion)	Now	27	744	South
	- Hingham Force Main	Now	24	7,600	South
24	Wellesley Extension Sewer				
	- Section 98	Now	90	3,350	South
	- Section 99	Now	84	3,300	South
	- Section 100	Now	84	3,920	South
	- Section 101 (Portion)	Now	84	2,420	South
	- Section 101 (Portion)	Now	90	1,420	South
	- Section 102	Now	90	6,850	South
	- Section 103	Now	90	5,920	South
	- Section 104	Now	90	4,300	South
	- Section 105	Now	90	4,425	South
	- Section 106	Now	90	4,350	South

TABLE 4-3 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 3

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
25	Framingham Extension Sewer				
	- Section 132 (Portion)	Now	90	3,590	South
	- Section 132 (Portion)	Now	66	6,910	South
	- Section 133B (Portion)	Now	66	11,090	South
	- Section 133B (Portion)	Now	60	2,000	South
	- Section 134	Now	60	8,175	South
26	Wellesley Extension Relief Sewer				
	- Section 137 A	2000	90	1,600	South
	- Section 137	2000	90	12,490	South
	- Section 138 (Portion)	2000	90	1,590	South

1. Force main.
2. Minimum recommended relief size is 12 inches.

Nut Island service area	From 64,600 to 40,400 sewered acres

Figure 4-1 shows the extent of relief to the existing system required in this plan. Table 4-4 lists all interceptors that require relief, year relief required, and the sizes and lengths of the relief sewers.

Estimated Costs and Priorities

Table 4-5 lists estimated costs of improvements for the various groups of interceptors under the four alternative concepts. The listed costs are divided into two categories; Present and Future. All interceptors that require relief now or in the near future (by 1980) are considered as present relief requirements. All other interceptors that require relief after 1980 are considered as future relief requirements. The estimated costs presented in Table 4-5 are based on estimated January 1975 ENR Index 2200 and include a 25 percent allowance for engineering and contingency.

Cost estimates presented do not include costs for extension sewers needed for connecting additional towns and communities to the existing North and South Metropolitan systems under the four alternate concepts. Table 4-6 lists the costs of these extension sewers and the total costs under the four concepts.

During the process of modeling the MDC interceptor system it was found that certain interceptor sections are already heavily surcharged and require immediate relief. In order to alleviate sewer surcharging and associated problems in these interceptors, it is suggested that highest priority be given to final engineering and design of these relief sewers. Table 4-7 lists the MDC interceptors that require high priority attention for relief under the four alternate concepts and the associated costs.

TABLE 4-4. MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 4

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
1	Millbrook Valley Sewer				
	- Section 84	Now	42	1,060	North
	- Section 85	Now	42	11,680	North
2	Wilmington Extension Sewer				
	- Section 89 (Portion)	2000	36	870	North
	- Section 90	2000	36	8,660	North
3	Reading Extension Sewer				
	- Section 76 (Portion)	Now	42	1,360	North
	- Section 76 (Portion)	Now	24 (FM)(1)	1,350	North
	- Section 75 (Portion)	Now	30	5,460	North
6	Chelsea Branch Sewer				
	- Section 57 (Portion)	Now	21	1,140	North
7	Stoneham Extension Sewer				
	- Section 51 (Portion)	Now	8(2)	1,000	North
	- Section 51 (Portion)	Now	10(2)	3,130	North
8	Stoneham Trunk Sewer				
	- Section 42	Now	18	3,050	North
9	Wakefield Branch Sewer				
	- Section 50 (Portion)	2000	15	3,090	North
	- Section 50 (Portion)	Now	42	1,580	North
	- Section 49	Now	36	3,880	North

TABLE 4-4 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 4

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
10	Wakefield Trunk Sewer				
	- Section 41 (Portion)	2000	54	3,040	North
	- Section 41 (Portion)	2000	48	2,700	North
	- Section 40	2000	48	6,235	North
11	North Charles Metropolitan Sewer				
	- Section 63 (Portion)	Now	24	1,310	North
	- Section 63 (Portion)	Now	30	1,400	North
	- Section 63 (Portion)	Now	36	3,100	North
12	South Charles Relief Sewer				
	- Section 4A (Portion)	Now	36	5,120	North
	- Section 4A (Portion)	Now	48	3,840	North
13	South Charles Sewer				
	- Section H (Portion)	Now	48	1,440	North
	- Section H (Portion)	2000	30	3,040	North
	- Section G	2000	30	2,800	North
	- Section F	2000	36	2,090	North
18	Upper Neponset Valley Sewer				
	- Section 26 (Portion)	Now	30	1,860	South
	- Section 27	Now	30	3,460	South
	- Section 28	Now	30	4,570	South
	- Section 29 (Portion)	Now	30	450	South
	- Section 29 (Portion)	Now	24	4,250	South
	- Section 30	Now	24	6,720	South

TABLE 4-4 (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 4

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
19	New Neponset Valley Sewer				
	- Section 113 (Portion)	Now	84	4,670	South
	- Section 113 (Portion)	Now	78	630	South
	- Section 114	Now	78	5,800	South
	- Section 115 (Portion)	Now	78	4,330	South
	- Section 115 (Portion)	Now	54	1,705	South
20	Stoughton Extension Sewer				
	- Section 119 (Portion)	Now	54	3,220	South
	- Section 119 (Portion)	2000	36	40	South
	- Section 120	2000	36	3,300	South
	- Section 121 (Portion)	2000	24	1,550	South
	- Section 121 (Portion)	Now	36	1,660	South
	- Section 121 (Portion)	Now	30	2,270	South
21	Walpole Extension Sewer				
	- Section 116 (Portion)	Now	60	800	South
	- Section 116 (Portion)	Now	54	4,400	South
	- Section 117	Now	54	5,740	South
	- Section 118	Now	48	4,930	South
22	Westwood Extension Sewer				
	- Section 135	2000	30	5,610	South
	- Section 136	2000	30	6,700	South

TABLE --- (Continued). MDC INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPT 4

Group No.	Interceptor requiring relief	Year relief required	Relief sewer size, in.	Length, ft.	System
23	Braintree-Weymouth Extension Sewer				
	- Section 122	Now	60	5,530	South
	- Section 123	Now	60	1,626	South
	- Section 124	Now	60	3,082	South
	- Section 125(Portion)	Now	60	2,878	South
	- Section 125(Portion)	Now	27	744	South
	- Hingham Force Main	Now	24	7,600	South
24	Wellesley Extension Sewer				
	- Section 102	2000	48	6,850	South
	- Section 103	2000	48	5,920	South
	- Section 104	2000	48	4,300	South
	- Section 105	2000	48	4,425	South
	- Section 106	2000	48	4,350	South

1. Force main.
2. Minimum recommended relief size is 12 inches.

TABLE 4-5. ESTIMATED COST OF INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPTS STUDIED

Group[1] No.	System	Costs of interceptor improvements in millions of dollars							
		Concept 1		Concept 2		Concept 3		Concept 4	
		Present	Future	Present	Future	Present	Future	Present	Future
1	North	$ 3.6	-	$ 3.6	-	$ 3.6	-	$ 3.6	-
2	North	-	$ 3.2	-	$ 3.2	-	$ 3.2	-	$ 3.2
3	North	1.2	0.8	1.2	0.8	1.2	0.8	1.2	-
4	North	1.2	0.5	1.2	0.5	1.2	0.5	-	-
5	North	-	0.6	-	0.6	-	0.6	-	-
6	North	0.2	-	0.2	-	0.2	-	0.2	-
7	North	0.8	-	0.8	-	0.8	-	0.8	-
8	North	0.5	-	0.5	-	0.5	-	0.5	-
9	North	0.8	0.2	0.8	0.7	0.8	0.2	0.8	0.2
10	North	-	5.0	-	5.0	-	5.0	-	5.0
11	North	1.2	-	1.2	-	1.2	-	1.2	-
12	North	2.3	-	2.3	-	2.3	-	2.3	-
13	North	0.4	1.2	0.4	1.2	0.4	1.2	0.4	1.2
14	North	12.0	-	-	-	12.0	-	-	-
15	North	0.6	-	-	-	0.6	-	-	-
16	North	0.2	-	-	-	0.2	-	-	-
Subtotal	North	$25.0	$11.5	$12.2	$11.5	$25.0	$11.5	$10.9	$ 9.6

1. Group numbers in this table correspond to those in Tables 4-1, 4-2, 4-3, and 4-4.

TABLE 4-5 (Continued). ESTIMATED COST OF INTERCEPTOR RELIEF REQUIREMENTS UNDER CONCEPTS STUDIED

Group(1)		Costs of interceptor improvements in millions of dollars							
		Concept 1		Concept 2		Concept 3		Concept 4	
No.	System	Present	Future	Present	Future	Present	Future	Present	Future
Subtotal	North	$ 25.0	$ 11.5	$ 12.2	$ 11.5	$ 25.0	$ 11.5	$ 10.9	$ 9.6
17	South	-	20.4	-	-	-	88.0	-	-
18	South	9.3	-	9.3	-	9.3	-	9.3	-
19	South	15.3	14.8	0.6	-	15.3	14.8	8.4	-
20	South	1.6	0.8	1.6	0.8	1.6	0.8	1.6	0.8
21	South	12.1	-	12.1	-	12.1	-	12.1	-
22	South	-	2.4	-	2.4	-	2.4	-	2.4
23	South	7.5	-	7.5	-	7.5	-	7.5	-
24	South	14.2	-	-	6.4	17.8	-	-	6.4
25	South	22.5	-	-	-	22.9	-	-	-
26	South	-	-	-	-	-	23.4	-	-
Subtotal	South	$ 82.5	$ 38.4	$ 31.1	$ 9.6	$ 86.5	$129.4	$ 38.9	$ 9.6
Total	North & South	$107.5	$ 49.9	$ 43.3	$ 21.1	$111.5	$140.9	$ 49.8	$ 19.2

1. Group numbers in this table correspond to those in Tables 4-2, 4-3, 4-4, and 4-5.

TABLE 4-6. ESTIMATED COSTS OF INTERCEPTOR IMPROVEMENTS AND EXTENSION SEWERS

Description	Concept 1		Concept 2		Concept 3		Concept 4	
	Present	Future	Present	Future	Present	Future	Present	Future
Extension sewers	$ 8.5	-	$ 6.2	-	$ 46.4	-	$ 6.2	-
Existing North and South system improvements(1)	107.5	$ 49.9	43.3	$ 21.1	111.5	$140.9	49.8	$ 19.2
Total	$116.0	$ 49.9	$ 49.5	$ 21.1	$157.9	$140.9	$ 56.0	$ 19.2

1. From Table 4-5.

TABLE 4-7. MDC INTERCEPTORS REQUIRING HIGH-PRIORITY RELIEF AND ASSOCIATED COSTS

Group(1) No.	Interceptor system	Relief required or not under Concept 1	Concept 2	Concept 3	Concept 4
1	Millbrook Valley Sewer (Sections 84 and 85)	$ 3,600,000	$ 3,600,000	$ 3,600,000	$ 3,600,000
3	Reading Extension Sewer (Sections 75 and 76)	$ 1,200,000	$ 1,200,000	$ 1,200,000	$ 1,200,000
12	South Charles Relief Sewer (Section 4A)	$ 2,300,000	$ 2,300,000	$ 2,300,000	$ 2,300,000
23	Braintree-Weymouth Extension Sewer (Sections 122 through 125 and Hingham force main)	$ 7,500,000	$ 7,500,000	$ 7,500,000	$ 7,500,000
24	Wellesley Extension Sewer (Sections 98 through 106)	$14,200,000	-	$17,800,000	-
25	Framingham Extension Sewer (Sections 132 through 134)	$22,500,000	-	$22,900,000	-
Total		$51,300,000	$14,600,000	$55,300,000	$14,600,000

1. Group numbers in this table correspond to group numbers in Tables 4-2, 4-3, 4-4, 4-5, and 5-1.

CHAPTER 5

INTERCEPTOR RELIEF REQUIREMENTS UNDER THE RECOMMENDED PLAN

General

The Recommended Plan visualizes the addition of the Towns of Lincoln, Lynnfield and Weston to the North Metropolitan System and Dover, Hopkinton, Sharon, Sherborn and Southborough to the South Metropolitan System. In addition, two new satellite wastewater treatment plants are proposed for the South Metropolitan System - discharging to the middle Charles and upper Neponset Rivers. The proposed Middle Charles Treatment Plant would serve Ashland, Framingham, Hopkinton, Natick, Sherborn and Southborough and parts of Dover and Wellesley. The proposed Upper Neponset Treatment Plant would treat wastewater from Sharon, Stoughton and Walpole and parts of Canton and Norwood. Under this Recommended Plan areas served by the four treatment plants would be as follows:

Existing Deer Island Treatment Plant	From 68,200 to 87,600 sewered acres in year 2000
Existing Nut Island Treatment Plant	From 64,600 to 58,000 sewered acres in year 2000
Proposed Middle Charles Plant	24,100 sewered acres in year 2000
Proposed Upper Neponset Plant	17,200 sewered acres in year 2000

Relief Requirements

MDC interceptors requiring relief under the Recommended Plan are shown in Figure 5-1 (bound in back). The extent and size of pipes to be relieved are shown in Table 5-1 along with the estimated time when such relief would be required.

Relief sizes shown in Table 5-1 are based on the assumption that such relief would be constructed parallel to existing pipes. In final design, other more appropriate alignments, and slopes may be selected. For this reason, the design flows for each sewer to be relieved is presented in Table 5-2.

TABLE 5-1. RELIEF REQUIREMENTS UNDER THE RECOMMENDED PLAN

Group No.	Name and MDC section number of interceptor requiring relief	System	Time relief required	Relief sewer Size, (in.)	Relief sewer Length, (ft)
1	Millbrook Valley Sewer				
	- Section 84	North	1980-85	36	1,060
	- Section 85	North	1980-85	36	11,680
2	Wilmington Extension Sewer				
	- Section 89 (Portion)	North	2000	30	870
	- Section 90	North	2000	30	8,660
3	Reading Extension Sewer				
	- Section 76 (Portion)	North	Ongoing	42	1,360
	- Section 76 (Portion)	North	Ongoing	24 (FM)(1)	1,350
	- Section 75 (Portion)	North	Ongoing	30	5,460
4	North Metropolitan Sewer				
	- Sections 44-1/2, 67,112	North	2000	54	2,000
	- Section 17 (Portion)	North	1985-90	60	2,600
5	Chelsea Branch Sewer				
	- Section 57 (Portion)	North	1985-90	21	1,140
6	Revere Extension Sewers				
	- Section 57A	North	1990-95	12	1,030
	- Section 62	North	1990-95	30	3,180
7	Stoneham Extension Sewer				
	- Section 51 (Portion)	North	1985-90	12	4,130
8	Stoneham Trunk Sewer				
	- Section 42	North	1985-90	18	3,050

TABLE 5-1 (Continued). RELIEF REQUIREMENTS UNDER THE RECOMMENDED PLAN

Group No.	Name and MDC section number of interceptor requiring relief	System	Time relief required	Relief sewer Size, (in.)	Relief sewer Length, (ft)
9	Wakefield Branch Sewer				
	- Section 50-60 (Portion)	North	2000	15	3,090
	- Section 50-60 (Portion)	North	1985-90	42	1,580
	- Section 49-59, 49-60	North	1985-90	42	3,880
10	Wakefield Trunk Sewer				
	- Section 59-41 (Portion)	North	2000	48	3,040
	- Section 58-41 (Portion)	North	2000	42	2,700
	- Section 87-40	North	2000	42	6,235
11	North Charles Metropolitan Sewer				
	- Section 63 (Portion)	North	1980-85	24	2,710
	- Section 63 (Portion)	North	1980-85	36	3,100
12	South Charles Relief Sewer				
	- Section 4A (Portion)	North	1990-95	36	5,120
	- Section 4A (Portion)	North	1990-95	48	3,840
13	South Charles Relief Sewer				
	- Section 4-H (Portion)	North	1990-95	48	1,440
	- Section 4-H (Portion)	North	2000	36	3,040
	- Section 4-G	North	2000	42	2,800
	- Section 4-F	North	2000	42	7,690
	- Section 3-F	North	2000	42	5,720
	- Section 3-E	North	2000	42	3,680
14	South Charles River Sewer				
	- Section 5-C (Portion)	North	2000	54	2,300
	- Section 5-B and 5-A (Portion)	North	1990-95	66	5,510

TABLE 5-1 (Continued). RELIEF REQUIREMENTS UNDER THE RECOMMENDED PLAN

Group No.	Name and MDC section number of interceptor requiring relief	System	Time relief required	Relief sewer Size, (in.)	Relief sewer Length, (ft)
15	Charles River Crossing - Section 204 (cost included with Section 5-C)	North	2000	54	600
16	Cross-Connection Between South Charles River Sewer and South Charles Relief Sewer (cost included with Section 5-C)	North	2000	36	700
17	Cummingsville Branch Sewer - Section 47-86	North	1990-95	36	4,970
18	Somerville-Medford Branch Sewer				
	- Section 35 (Portion)	North	1985-90	24	7,470
	- Section 35 (Portion)	North	1985-90	42	920
19	Upper Neponset Valley Sewer				
	- Section 26 (Portion)	South	Ongoing	36	1,860
	- Section 27	South	Ongoing	36	3,460
	- Section 28	South	Ongoing	36	4,570
	- Section 29 (Portion)	South	Ongoing	36	450
	- Section 29 (Portion)	South	Oinging	24	4,250
	- Section 30	South	Ongoing	24	6,720

TABLE 5-1 (Continued). RELIEF REQUIREMENTS UNDER THE RECOMMENDED PLAN

Group No.	Name and MDC section number of interceptor requiring relief	System	Time relief required	Relief sewer Size, (in.)	Relief sewer Length, (ft)
20	New Neponset Valley Sewer				
	- Section 115 (Portion)	South	1980-85	78	500(2)
	- Section 115 (Portion)	South	1980-85	54	1,705
21	Stoughton Extension Sewer				
	- Section 119 (Portion)	South	1980-85	54	3,220
	- Section 119 (Portion)	South	2000	36	40
	- Section 120	South	2000	36	3,300
	- Section 121 (Portion)	South	2000	24	1,550
	- Section 121 (Portion)	South	1980-85	36	1,660
	- Section 121 (Portion)	South	1980-85	30	2,270
22	Walpole Extension Sewer				
	- Section 116 (Portion)	South	1980-85	60	800
	- Section 116 (Portion)	South	1980-85	60	4,400
	- Section 117	South	1980-85	60	5,740
	- Section 118	South	1980-85	48	4,930
23	Westwood Extension Sewer				
	- Section 135	South	2000	30	5,610
	- Section 136	South	2000	30	6,700
24	Braintree-Weymouth Extension Sewer				
	- Section 122	South	Ongoing	60	5,530
	- Section 123	South	Ongoing	60	1,626
	- Section 124	South	Ongoing	60	3,082
	- Section 125 (Portion)	South	Ongoing	60	2,878
	- Section 125 Branch (Portion)	South	1980-85	24	744
	- Hingham Force Main	South	1980-85	24 (FM)	7,600

TABLE 5-1 (Continued). RELIEF REQUIREMENTS UNDER THE RECOMMENDED PLAN

Group No.	Name and MDC section number of interceptor requiring relief	System	Time relief required	Relief sewer Size, (in.)	Relief sewer Length, (ft)
25	Framingham Extension Sewer				
	- Section 132	South	1980-85	66	10,500
	- Section 133B (Portion)	South	1980-85	66	11,090
	- Section 133B (Portion)	South	1980-85	60	2,000
	- Section 134	South	1980-85	60	8,175

1. Force main.
2. Up to proposed treatment plant in Canton.

TABLE 5-2. DESIGN FLOWS FOR MDC INTERCEPTORS REQUIRING RELIEF

No.	Name and MDC section number of interceptor requiring relief	Total existing capacity, (cfs)	Total design flow, (cfs)	Design flow year
1	Millbrook Valley Sewer			
	- Section 84	16.1	35.9	2020
	- Section 85 (Portion)	16.6	35.9	2020
	- Section 85 (Portion)	14.9	35.9	2020
	- Section 85 (Portion)	14.0	35.9	2020
2	Wilmington Extension Sewer			
	- Section 89 (Portion)	29.0	33.0	2050
	- Section 90 (Portion)	28.5	33.0	2050
	- Section 90 (Portion)	17.5	33.0	2050
	- Section 90 (Portion)	19.4	33.0	2050
3	Reading Extension Sewer			
	- Section 75	8.0	24.2	2020
	- Section 76	6.2	24.2	2020
4	North Metropolitan Sewer			
	- Sections 44-1/2-67-112	98.9(1)	129.0	2050
	- Sections 17-87	118.0(1)	165.0	2020
5	Chelsea Branch Sewer			
	- Section 57	5.9	9.3	2020
6	Revere Extension Sewer			
	- Section 57A	2.3	3.2	2020
	- Section 62	23.4	28.8	2020
7	Stoneham Extension Sewer			
	- Section 51	3.7	5.3	2020

TABLE 5-2 (Continued). DESIGN FLOWS FOR MDC INTERCEPTORS REQUIRING RELIEF

No.	Name and MDC section number of interceptor requiring relief	Total existing capacity, (cfs)	Total design flow, (cfs)	Design flow year
8	Stoneham Trunk Sewer			
	- Section 42	1.4	4.5	2020
9	Wakefield Branch Sewer			
	- Sections 50-60 (Portion)	29.1 (1)	35.6	2050
	- Sections 50-60 (Portion)	22.5 (1)	48.7	2020
	- Sections 49-60 and 49-59	22.5 (1)	51.7	2020
10	Wakefield Trunk Sewer			
	- Sections 59-41 (Portion)	44.9 (1)	58.8	2050
	- Sections 58-41 (Portion)	50.6 (1)	69.8	2050
	- Sections 87-40	72.2 (1)	88.6	2050
11	North Charles Metropolitan Sewer			
	- Section 63 (Portion)	7.5	12.6	2020
	- Section 63 (Portion)	7.5	21.1	2020
12	South Charles Relief Sewer			
	- Section 4A (Portion)	17.8	53.2	2020
	- Section 4A (Portion)	28.6	68.6	2020
13	South Charles Relief Sewer			
	- Sections 4-H (Portion)	53.4 (1)	98.0	2020
	- Sections 4-H (Portion)	97.3 (1)	114.0	2050
	- Sections 4-G	98.1 (1)	121.2	2050
	- Sections 4-F	98.1 (1)	122.0	2050
	- Sections 3-F	122.0 (1)	140.0	2050
	- Sections 3-E	129.0 (1)	166.0	2050

TABLE 5-2 (Continued). DESIGN FLOWS FOR MDC INTERCEPTORS REQUIRING RELIEF

No.	Name and MDC section number of interceptor requiring relief	Total existing capacity, (cfs)	Total design flow, (cfs)	Design flow year
14	South Charles River Sewer			
	- Sections 5-C	232.0(1)	267.0	2050
	- Sections 5-B and 5-A	236.0(1)	291.0	2020
15	Charles River Crossing			
	- Section 204	227.0	267.0	2020
16	Cross Connection Between South Charles River Sewer (c) and South Charles Relief Sewer (1)	31.5	49.4	2020
17	Cummingsville Branch Sewer			
	- Sections 47-86	20.2	43.8	2020
18	Somerville-Medford Branch Sewer			
	- Section 35 (Portion)	6.8	8.9	2020
	- Section 35 (Portion)	14.0	17.0	2020
	- Section 35 (Portion)	17.6	29.9	2020
19	Upper Neponset Valley Sewer			
	- Section 26 (Portion)	15.4	26.3	2020
	- Section 27 (Portion)	15.9	26.3	2020
	- Section 27 (Portion)	7.7	24.1	2020
	- Section 28 (Portion)	12.8	24.1	2020
	- Section 28 (Portion)	9.2	24.1	2020
	- Section 29 (Portion)	9.0	24.1	2020
	- Section 29 (Portion)	5.1	9.4	2020
	- Section 30 (Portion)	9.6	12.4	2020
	- Section 30 (Portion)	4.6	12.4	2020

TABLE 5-2 (Continued). DESIGN FLOWS FOR MDC INTERCEPTORS REQUIRING RELIEF

No.	Name and MDC section number of interceptor requiring relief	Total existing capacity, (cfs)	Total design flow, (cfs)	Design flow year
20	New Neponset Valley Sewer			
	- Section 115 (Portion)	35.0	125.0	2020
	- Section 115 (Portion)	12.9	54.2	2020
21	Stoughton Extension Sewer			
	- Section 119 (Portion)	12.9	54.2	2020
	- Section 119 (Portion)	43.7	59.0	2050
	- Section 120 (Portion)	23.4	53.9	2050
	- Section 120 (Portion)	34.3	53.9	2050
	- Section 120 (Portion)	28.7	53.9	2050
	- Section 121 (Portion)	28.7	38.4	2050
	- Section 121 (Portion)	14.4	38.2	2020
	- Section 121 (Portion)	7.7	38.2	2020
	- Section 121 (Portion)	6.5	27.4	2020
22	Walpole Extension Sewer			
	- Section 116 (Portion)	26.0	75.4	2020
	- Section 116 (Portion)	32.0	70.5	2020
	- Section 117	25.5	64.2	2020
	- Section 118 (Portion)	19.7	57.8	2020
	- Section 118 (Portion)	13.1	52.6	2020
23	Westwood Extension Sewer			
	- Section 135 (Portion)	19.6	20.5	2050
	- Section 135 (Portion)	11.5	20.5	2050
	- Section 136 (Portion)	10.1	20.5	2050
	- Section 136 (Portion)	13.5	20.5	2050

TABLE 5-2 (Continued). DESIGN FLOWS FOR MDC INTERCEPTORS REQUIRING RELIEF

No.	Name and MDC section number of interceptor requiring relief	Total existing capacity, (cfs)	Total design flow, (cfs)	Design flow year
24	Braintree-Weymouth Extension Sewer			
	- Section 122 (Portion)	57.7	99.2	2020
	- Section 122 (Portion)	50.5	89.9	2020
	- Section 123	35.1	89.9	2020
	- Section 124 (Portion)	40.4	89.9	2020
	- Section 124 (Portion)	40.4	73.2	2020
	- Section 125	27.9	73.2	2020
	- Section 125 Branch	15.3	21.7	2020
	- Hingham Force Main	3.9	20.1	2020
25	Framingham Extension Sewer			
	- Section 132 (Portion)	37.5	124.0	2020
	- Section 132 (Portion)	37.8	121.0	2020
	- Section 133B (Portion)	37.8	121.0	2020
	- Section 133B (Portion)	46.1	121.0	2020
	- Section 133B (Portion)	40.9	121.0	2020
	- Section 133B (Portion)	37.8	97.1	2020
	- Section 134 (Portion)	37.0	97.1	2020
	- Section 134 (Portion)	25.9	86.7	2020

1. Combined capacity of parallel sewer sections.

The estimated cost of interceptor relief in accordance with the groupings of pipes presented in Table 5-1 is shown in Table 5-3.

Under the Recommended Plan, extension of interceptors will be required to serve expected new member communities. The estimated size, flow and cost of these is shown in Table 5-4 along with the projected date when such facilities will be needed.

TABLE 5-3. ESTIMATED COST OF INTERCEPTOR IMPROVEMENTS REQUIRED UNDER THE RECOMMENDED PLAN

No.[1]	Name of interceptor requiring relief	Estimated cost, (millions of dollars)
1	Millbrook Valley Sewer	3.8
2	Wilmington Extension Sewer	3.0
3	Reading Extension Sewer	On-going
4	North Metropolitan Sewer	1.7
5	Chelsea Branch Sewer	0.1
6	Revere Extension Sewer	3.4
7	Stoneham Extension Sewer	0.3
8	Stoneham Trunk Sewer	0.1
9	Wakefield Branch Sewer	1.0
10	Wakefield Trunk Sewer	4.8
11	North Charles Metropolitan Sewer	1.3
12	South Charles Relief Sewer	2.7
13	South Charles Relief Sewer	2.9
14	South Charles River Sewer	12.6
15	Charles River Crossing	Included in No. 14
16	Cross Connection	Included in No. 14
17	Cummingsville Branch Sewer	1.0
18	Somerville-Medford Branch Sewer	4.5
Subtotal North System		43.2
19	Upper Neponset Valley Sewer	On-going
20	New Neponset Valley Sewer	Included in No. 21
21	Stoughton Extension Sewer	1.9
22	Walpole Extension Sewer	11.9
23	Westwood Extension Sewer	2.4
24	Braintree-Weymouth Extension Sewer	0.9
25	Framingham Extension Sewer	22.5
Subtotal South System		39.6
Total North and South Systems		82.8

1. Numbers correspond to those in Table 5-1.

TABLE 5-4. INTERCEPTOR REQUIREMENTS FOR NEW COMMUNITIES UNDER THE RECOMMENDED PLAN

Interceptor designation	Size, (in.)	Length, (ft)	Cost, ($)
Lynnfield Extension Sewer	varies 12 in. to 21 in.	6,000	$ 367,000
Ashland-Hopkington Extension Sewer	varies 21 in. to 48 in.	36,700	$ 4,459,000
Weston Lincoln Extension Sewer	varies 30 in. to 42 in.	33,400	$ 3,832,000
Southboro Extension Sewer	varies 24 in. to 36 in.	26,800	$ 2,421,000
Sharon Extension Sewer	36 in.	7,400	$ 1,218,000
Total			$12,297,000

CHAPTER 6

WASTEWATER PUMPING STATION ANALYSIS AND IMPROVEMENTS

General

This chapter covers the following 10 existing pumping stations. Their approximate location and their dry weather flow service areas are shown on Figure 6-1 (bound in back).

Alewife Brook	East Boston Steam	Houghs Neck
Braintree-Weymouth	East Boston Electric	Quincy
Charlestown	Hingham	Reading
		Squantum

The remaining two, namely the Old Deer Island and Winthrop pumping stations are not discussed in this chapter due to their status of not being used. The Deer Island Pumping Station was not inventoried because it has been decommissioned and its prime pumping equipment has been removed. The Winthrop Pumping Station was, however, inventoried and is presented in Appendix F.

Under all of the wastewater management concepts under study, these pumping stations must be retained to provide for the needs of their service areas. The purpose of this chapter is to delineate the need for modifying these stations to meet present requirements more efficiently, and to determine the most economical designs that will provide pumping stations capable of meeting the requirements of their service areas some 25 years hence.

With the exception of the Alewife Brook and Hingham pumping stations, all are over 25 years old. Today's standards for the design of wastewater pumping stations are appreciably different from those generally accepted during the period when many of the existing facilities were constructed. Today's standards require more reliable operation and permit lower maintenance and operating cost, better access to the equipment and safer working conditions for the operating personnel. It can be anticipated that to meet today's design standards, many of the existing pumping stations will require such extensive modifications that replacement may be a preferable alternative.

Before presenting the findings on each pumping station, a general description of the function of the two East Boston pumping stations is given as follows and shown schematically on Figure 6-2. The East Boston Steam Pumping Station was constructed with the original North Metropolitan Sewer for the purpose of lifting sewage into the North Metropolitan Sewer after it crossed Chelsea Creek through siphons. Upon construction of a section of the North Metropolitan Relief Sewer down to Chelsea Creek, a temporary pumping station was constructed to lift flows from the relief sewer into Chelsea Creek until the relief sewer is extended to the outfalls off Deer Island. At that time, provision was also made for the East Boston Electric Pumping Station to function as a standby facility to the East Boston Steam Station. With the construction of the MDC tunnel system, namely the North Metropolitan Relief Tunnel and the Main Pumping Station at the Deer Island Treatment Plant, most flows normally entering the two East Boston pumping stations were diverted to the Chelsea Creek Headworks (described in the next chapter) for screening prior to entry into the tunnel. This has placed the two stations into a standby category except that the East Boston Steam Pumping Station still has to lift a relatively small amount of flow coming from the Orient Heights and East Boston Sewer. Flows from these two areas, plus flows from Winthrop, are the only sewage presently diverted to the lower end of the large North Metropolitan sewer during normal dry weather flows. In addition to acting as standby facilities for the Main Pumping Station at the Deer Island Treatment Plant, these facilities can also provide additional transmission capacity to Deer Island during wet weather flows.

Evaluation Procedure

Detailed inventories of the pumping stations were conducted by electrical and mechanical engineers experienced in pumping facility design and operation.

In addition, major pumping stations were inspected and evaluated by Mr. Allen J. Burdoin, consultant to Metcalf & Eddy, for their feasibility of upgrading.

The sections on pumping station improvements are the results of these inspections and evaluations.

Appendix E presents a list of abbreviations that were used extensively in the inventory analysis of both the pumping stations and headwork facilities. Appendix F presents a detailed inventory of the major equipment in the MDC pumping stations.

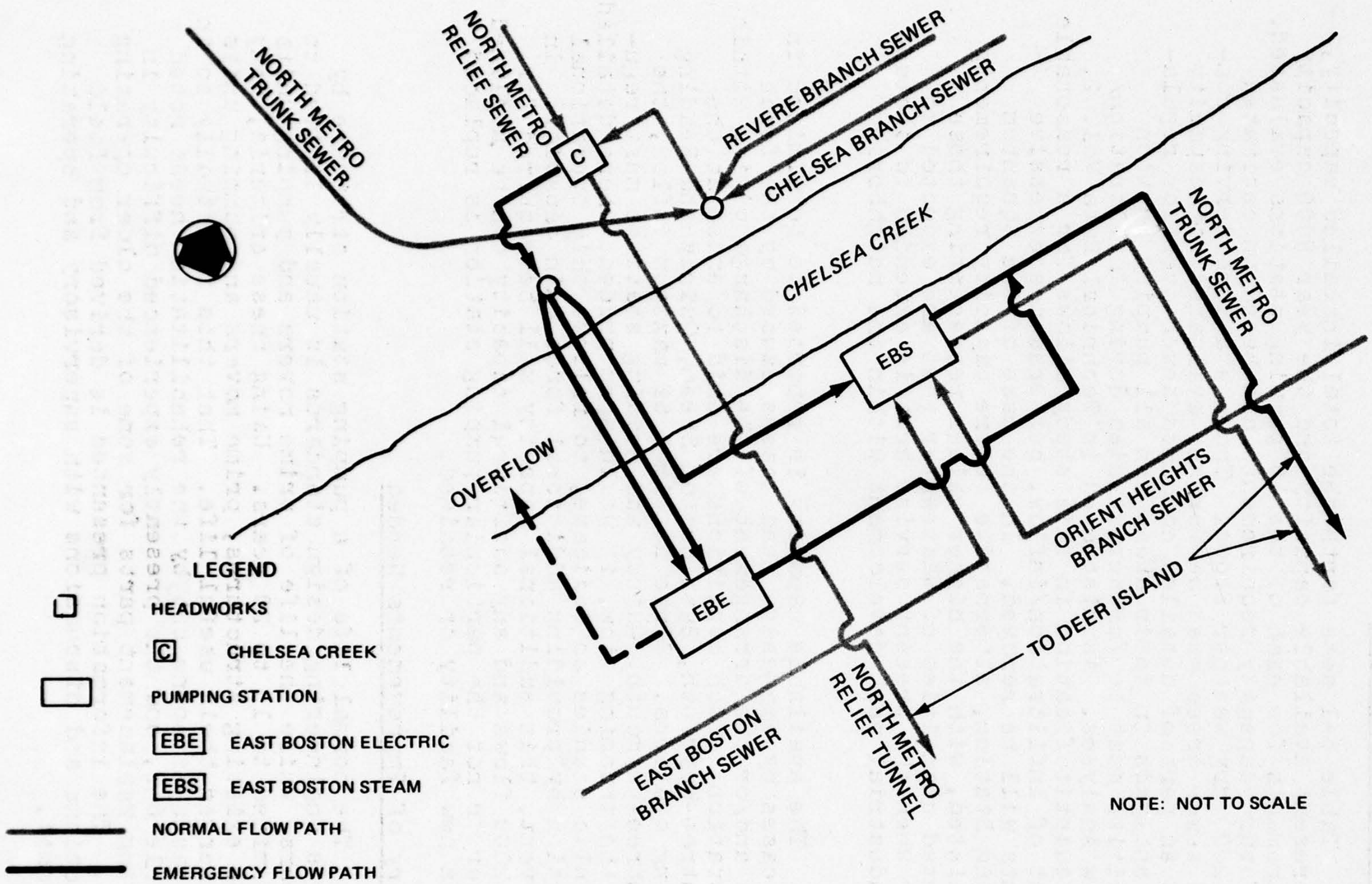

FIG. 6-2 FUNCTION OF MDC EAST BOSTON PUMPING STATIONS

Capacity Requirements

Table 6-1 sets forth the total installed capacity, the present available capacity and the year 2000 capacity requirements for each of the 10 pumping stations evaluated. The future capacity requirements are based on estimated year 2000 dry weather flows. Those stations serving combined sewer areas must be further evaluated for capacity needs as part of detailed combined sewer overflow regulation analysis in their areas and all pumping station capacities must be further studied during Infiltration/Inflow Analyses. As discussed in Technical Data Vol. 2, flow quantitification in this study allows for a reasonable amount of infiltration/inflow, but presumes excessive amounts will be removed. In the case of the Squantum Pumping Station, alternative future capacity requirements are listed, with the higher values representing those reported quantities of wastewater that are expected to occur when the present service area is extended to include an industrial park development within the neighboring area.

The available capacity is reported to be limited in some cases by excessive head losses caused by the force mains and/or the arrangement of the discharge piping within the station. Such conditions are said to exist at the Braintree-Weymouth, East Boston Steam, Quincy and Reading pumping stations. Since at times of maximum inflow, the Braintree-Weymouth, Quincy and Reading stations must regulate the incoming flow, it would seem prudent where detailed hydraulic studies so indicate, to relieve this operational condition by providing additional force main capacity. In any event, this additional capacity will be required for year 2000 flows and any additional capacity can be utilized whether or not the particular pumping station is replaced with a new facility or retained.

Summary of Improvements Needed

The normal life of a pumping station structure by today's engineering design standards is usually limited to 50 years, while the life of prime movers and pumping units are limited to 15 to 20 years. Using these criteria, many of the existing structures, prime movers and pumping units have served their useful life. That this is actually so in most cases is borne out by the rehabilitation needs noted in Table 6-2, and the presently experienced difficulty in securing replacement parts for some of the older operating units. The information presented is derived from field inspections and discussions with supervisory and operating personnel.

TABLE 6-1. FUTURE CAPACITY REQUIREMENTS FOR DRY WEATHER FLOWS - 2000

Pumping station	Total installed capacity, mgd	Installed capacity largest unit out of service, mgd	Estimated available capacity, mgd	2000 capacity requirements: Average dry weather, mgd	2000 capacity requirements: Peak dry weather, mgd	Type of area served	Remarks
Alewife Brook	90.6	64.4	90.6	13.7	30.9	Combined-separate	
Braintree-Weymouth	60	40	44[1]	26.9	58.7	Separate	Increased pumping capacity to 60 mgd with largest unit out of service.
Charlestown	140	90	140	33.3	73.3	Combined-separate	
East Boston Steam	205[3]	105	135-150[2]	8.8	20.0	Combined	Provide additional smaller capacity pumping units to handle dry weather flows.
East Boston Electric	125	50	125	Standby		Combined	
Hingham	4.2	2.8	3.5	2.5	8.3	Separate	Increase pumping capacity to 9 mgd with largest unit out of service.
Houghs Neck	2.8	1.4	-	1.2	2.2	Separate	Increase pumping capacity to 3 mgd with largest unit out of service.
Quincy	52	32	20.0[2]	14.5	26.2	Separate	
Reading	8	4	4.0[2]	4.9	14.0	Separate	Increase capacity.
Squantum	8	4	5.0	2.4	4.4	Separate	
Total	595		577	10.0	18.0[4]	Separate	Increase capacity.

1. Capacity controlled by condition discharge piping and capacity of force main.
2. Capacity controlled by force main.
3. Excluding the 45 mgd capacity pump that has been out of service for many years.
4. Estimates based on extensive industrial park development in expanded service area.

TABLE 6-2. IMMEDIATE REHABILITATION NEEDS

PUMPING STATION	AGE OF STATION yrs.	PUMPING EQUIPMENT CAPACITY mgd	AGE OF PUMPING EQUIPMENT yrs.	DRIVE UNITS	AGE OF DRIVE UNITS yrs.	FLOW MEASUREMENT DEVICE	MECHANICAL	E
ALEWIFE BROOK	23	3 UNITS @ 26.2 1 UNIT @ 12.0 TOTAL 90.6	23 23	100 H.P. ELECTRIC MOTORS 50 H.P. ELECTRIC MOTOR	23 23	NONE	OVERHAUL PUMPING EQUIPMENT MODIFY DISCHARGE PIPING, ADD CHECK VALVE & GATE VALVE REPLACE ORIGINAL BAR SCREENS AND CLEANING MECHANISMS WHEN NECESSARY	OVERHA REPAIR SYSTEM- UPGRADE
BRAINTREE - WEYMOUTH	39	2 UNITS @ 20 1 UNIT @ 20 TOTAL 60	3 16	220 H.P. DIESEL ENGINES 203 H.P. DIESEL ENGINE	3 16	NONE	REPLACE 16 YR. OLD DIESEL DRIVE AND PUMP UNIT ADD ADDITIONAL BAR SCREEN AND CLEANING MECHANISM REPLACE PRIMING SYSTEM OVERHAUL COOLING SYTEMS DRIVE UNITS 2 AND 3 REVISE INSIDE DISCHARGE PIPING ARRANGEMENT PROVIDE MOTORIZED SLUICE GATES IN INFLUENT LINE	PROVIDE PROVIDE LIGHTS SYSTEM.
CHARLESTOWN	74	2 UNITS @ 45 1 UNIT @ 50 TOTAL 140	18 12	175 H.P. DIESEL ENGINES 270 H.P. DIESEL ENGINE	18 12	NONE	REPLACE PUMPING UNITS REPLACE DIESEL ENGINES REPLACE SUCTION AND DISCHARGE PIPING REPLACE SUCTION AND DISCHARGE VALVES REPLACE BAR SCREENS	PROVIDE REPLACE
EAST BOSTON STEAM	84	1 UNIT @ 60 1 UNIT @ 45 1 UNIT @ 100 TOTAL 205 1 UNIT @ 45 NOT OPERABLE	23 84 60 84	UNIFLOW STEAM ENGINE STEAM ENGINE 750 H.P. DIESEL ENGINE STEAM ENGINE	23 84 17 84	NONE	REPLACE BAR SCREENS REPLACE STEAM ENGINE AND PUMPS AS NECESSARY REPLACE VALVES IN SUCTION AND DISCHARGE PIPING	UPGRADE
EAST BOSTON ELECTRIC AND CHELSEA SCREEN CHAMBER	30	1 UNIT @ 75 1 UNIT @ 50 TOTAL 125	30 30	600 H.P. ELECTRIC MOTOR 400 H.P. ELECTRIC MOTOR	30 30	VENTURI METER (NOT CONNECTED)	REPLACE BAR SCREENS REPAIR VENTURI INDICATING SYSTEM PROVIDE NEW PRIMING SYSTEM CHECK PUMPS TO DETERMINE IF THEY REQUIRE REPLACEMENT	PROVIDE OF POWER GENERATO PROVIDE CHAMBER RECONNEC AUTOMATI
[illegible]	17	[illegible] UNITS @ 1.4 TOTAL 4.2	17	60 H.P. ELECTRIC MOTORS	17	PARSHALL FLUME	REPLACE PUMPING UNITS REPLACE GATE VALVES IN DISCHARGE PIPING PROVIDE VENTURI	PROVIDE OF POWER GENERATO

EHABILITATION NEEDS OF MDC PUMPING STATIONS

IMMEDIATE REHABILITATION NEEDS					
MECHANICAL	ELECTRICAL	ARCHITECTURAL	HEATING - PLUMBING	VENTILATING	OUTSIDE PIPING
OVERHAUL PUMPING EQUIPMENT MODIFY DISCHARGE PIPING, ADD CHECK VALVE & GATE VALVE REPLACE ORIGINAL BAR SCREENS AND CLEANING MECHANISMS WHEN NECESSARY	OVERHAUL ELECTRIC MOTORS REPAIR AUTOMATIC CONTROL SYSTEM-REPLACE RHEOSTATS UPGRADE FLOURESCENT LIGHTING	REPAIR ROOF REPLACE GUTTERS POINT UP WALLS	INSTALL NEW BOILER & NEW HEATING SYSTEM INSTALL NEW OUTSIDE FUEL TANK	INSTALL NEW VENTILATION SYSTEM IN WET WELL AREA PROVIDE VENTILATION IN WET WELL AND BAR SCREEN AREAS	PROVIDE VENTURI METERS IN OUTSIDE FORCE MAINS PROVIDE VENTURI METER REPLACE AND REDESIGN FORCE MAIN
REPLACE 16 YR. OLD DIESEL DRIVE AND PUMP UNIT ADD ADDITIONAL BAR SCREEN AND CLEANING MECHANISM REPLACE PRIMING SYSTEM OVERHAUL COOLING SYTEMS DRIVE UNITS 2 AND 3 REVISE INSIDE DISCHARGE PIPING ARRANGEMENT PROVIDE MOTORIZED SLUICE GATES IN INFLUENT LINE	PROVIDE AC SUPPLY TO BOILER PROVIDE AC SUPPLY FOR LIGHTS & REVISE LIGHTING SYSTEM.	PROVIDE ISOLATED AREA FOR BOILER PROVIDE WORKSHOP AREA REPLACE GUTTERS REPLACE WINDOWS POINT UP WALLS PROVIDE STORAGE AREA	INSTALL NEW BOILER AND HEATING SYSTEM INSTALL NEW PLUMBING SYSTEM		
REPLACE PUMPING UNITS REPLACE DIESEL ENGINES REPLACE SUCTION AND DISCHARGE PIPING REPLACE SUCTION AND DISCHARGE VALVES REPLACE BAR SCREENS	PROVIDE A.C. SERVICE REPLACE ELECTRIC LIGHTING	POINT UP WALLS REPAIR FLOORS	REPLACE BOILER AND HEATING SYSTEM	PROVIDE ADEQUATE VENTILATION IN SCREEN ROOM AND PUMP PITS.	PROVIDE VENTURI METER
REPLACE BAR SCREENS REPLACE STEAM ENGINE AND PUMPS AS NECESSARY REPLACE VALVES IN SUCTION AND DISCHARGE PIPING	UPGRADE ELECTRIC LIGHTING	REPAIR ROOF POINT UP WALLS REPAIR BOILER ROOM FLOOR PROVIDE NEW WINDOWS	UPGRADE BOILER AND HEATING SYSTEM	INSTALL VENTILATION IN SCREEN ROOM & PUMP PITS	PROVIDE VENTURI METER IN OUTSIDE FORCE MAIN
REPLACE BAR SCREENS REPAIR VENTURI INDICATING SYSTEM PROVIDE NEW PRIMING SYSTEM CHECK PUMPS TO DETERMINE IF THEY REQUIRE REPLACEMENT	PROVIDE ANOTHER SOURCE OF POWER OR STANDBY GENERATOR PROVIDE LIGHTING SCREEN CHAMBER RECONNECT AND UPGRADE AUTOMATIC CONTROL SYSTEM		PROVIDE BOILER AND HEATING SYSTEM FOR PUMPING STATION IF EAST BOSTON STEAM IS ABANDONED	PROVIDE IMPROVED VENTILATION IN SCREEN CHAMBER AND ELECTRIC PUMPING STATION	
REPLACE PUMPING UNITS REPLACE GATE VALVES IN DISCHARGE PIPING PROVIDE VENTURI	PROVIDE ANOTHER SOURCE OF POWER OR STANDBY GENERATOR				ELIMINATE OVERFLOWS

TABLE 6-2 (Continued). IMMEDIATE REHABILIT

PUMPING STATION	AGE OF STATION yrs.	PUMPING EQUIPMENT CAPACITY mgd	AGE OF PUMPING EQUIPMENT yrs.	DRIVE UNITS	AGE OF DRIVE UNITS yrs.	FLOW MEASUREMENT DEVICE	MECHANICAL
HOUGHS NECK	33	2 UNITS @ 1.4 TOTAL 2.8	1	10 H.P. ELECTRIC MOTORS	7	VENTURI (NOT CONNECTED)	UPDATE MOTOR CONTROL SYSTE AND VENTURI RECORDING SYSTE PROVIDE SUMP PUMP MODERNIZE WET WELL ARRANGEMENT
QUINCY	73	2 UNITS @ 20 1 UNIT @ 12 TOTAL 52	24 17	170 H.P. DIESEL ENGINES 66 H.P. DIESEL ENGINE	24 77	VENTURI (NOT CONNECTED)	REPLACE PUMPING UNITS NO. 1 AND NO. 2 AND DIESEL ENGINES REPAIR VENTURI REPAIR CHECK VALVES ON DISCHARGE REPLACE AND RELOCATE ONE BAR SCREEN REPLACE PRIMING SYSTEM REVAMP INSIDE DISCHARGE PIPING
READING	54	1 UNIT @ 4 1 UNIT @ 4 TOTAL 8	2 UNKNOWN	100 H.P. ELECTRIC MOTOR 120 H.P. DIESEL ENGINE 100 H.P. ELECTRIC MOTOR	UNKNOWN 22 50	NONE	REPLACE ONE PUMPING UNIT AND TWO ELECTRIC MOTORS ADD ADDITIONAL PUMPING UNIT RECONSTRUCT WET WELL PROVIDE NEW BAR SCREENS AND BAR SCREEN CHAMBER REPLACE DIESEL UNIT OR PROVIDE STANDBY SOURCE OF POWER
SQUANTUM	38	1 UNIT @ 4 1 UNIT @ 4 TOTAL 8	38 38	60 H.P. ELECTRIC MOTOR 80 H.P. DIESEL ENGINE 60 H.P. ELECTRIC MOTOR	38 38	VENTURI (NOT CONNECTED)	PROVIDE MECHANICALLY CLEANED BAR SCREENS REPLACE PUMPING EQUIPMENT REPLACE GATE VALVES IN SUCTION PIPING RECONSTRUCT WET WELL CONNECT VENTURI

IMMEDIATE REHABILITATION NEEDS OF MDC PUMPING STATIONS

MEASUREMENT DEVICE	IMMEDIATE REHABILITATION NEEDS					
	MECHANICAL	ELECTRICAL	ARCHITECTURAL	HEATING - PLUMBING	VENTILATING	OUTSIDE PIPING
VENTURI (CONNECTED)	UPDATE MOTOR CONTROL SYSTEM AND VENTURI RECORDING SYSTEM PROVIDE SUMP PUMP MODERNIZE WET WELL ARRANGEMENT	GENERAL REWIRING			UPGRADE VENTILATION SYSTEM	
VENTURI (CONNECTED)	REPLACE PUMPING UNITS NO. 1 AND NO. 2 AND DIESEL ENGINES REPAIR VENTURI REPAIR CHECK VALVES ON DISCHARGE REPLACE AND RELOCATE ONE BAR SCREEN REPLACE PRIMING SYSTEM REVAMP INSIDE DISCHARGE PIPING	UPDATE ELECTRIC LIGHTING SYSTEM	REPAIR ROOF REPLACE GUTTERS REPLACE WINDOWS POINT UP WALLS	REPLACE AND RELOCATE BOILER UPDATE HEATING SYSTEM	PROVIDE ADEQUATE VENTILATION IN WET WELL AREA AND PUMP ROOM AREA	PROVIDE ADDITIONAL FORCE MAIN
NONE	REPLACE ONE PUMPING UNIT AND TWO ELECTRIC MOTORS ADD ADDITIONAL PUMPING UNIT RECONSTRUCT WET WELL PROVIDE NEW BAR SCREENS AND BAR SCREEN CHAMBER REPLACE DIESEL UNIT OR PROVIDE STANDBY SOURCE OF POWER	PROVIDE NEW MOTOR CONTROL CENTER PROVIDE NEW ELECTRIC MOTOR CONTROLS AND SWITCH GEAR UPDATE ELECTRICAL LIGHTING SYSTEM PROVIDE STANDBY GENERATOR	REPAIR ROOF REPAIR GUTTERS REPLACE AND MODERNIZE WINDOWS WATERPROOF WALLS PROVIDE ADEQUATE STORAGE AND WORKSHOP AREAS	PROVIDE NEW BOILER AND HEATING SYSTEM PROVIDE ADEQUATE PLUMBING FACILITIES	PROVIDE NEW VENTILATION FACILTIES THROUGHOUT	PROVIDE ADDITIONAL FORCE MAIN PROVIDE VENTURI METERS
VENTURI (NOT CONNECTED)	PROVIDE MECHANICALLY CLEANED BAR SCREENS REPLACE PUMPING EQUIPMENT REPLACE GATE VALVES IN SUCTION PIPING RECONSTRUCT WET WELL CONNECT VENTURI	PROVIDE STANDBY GENERATOR	REPAIR GUTTERS REPLACE WINDOWS	PROVIDE NEW BOILER AND HEATING SYSTEM	PROVIDE ADEQUATE VENTILATION THROUGHOUT	

The older stations namely, Charlestown, East Boston Steam, Quincy and Reading, require the most rehabilitation work. These stations range from 54 to 84 years of age. Generally, the rehabilitation work consists of providing new heating and electrical systems, replacement of drive and pumping units, providing adequate ventilation, modifying suction and discharge valves and piping, and installing new or additional bar screens.

At most pumping stations, it is anticipated that new drive units would consist of electric motors or drives of a type that can be controlled to regulate their speed in accordance with the level of wastewater in the wet well and correspondingly the output of the pumps. It is also preferred to locate the casing of the pumps below the minimum level of wastewater in the wet well, to avoid the installation of priming equipment which can be quite troublesome from a maintenance and automatic control operation standpoint.

To properly operate a pumping facility and to accurately monitor the wastewater flows within a wastewater collection and treatment system, it is necessary to continually measure and record the flows that are discharged by pumping stations. In many instances, adequate flow measuring devices are not available at the existing stations. For this reason, the rehabilitation work includes the installation of meters for this purpose.

It is important in certain instances that some of the rehabilitation work be undertaken immediately, because the ability of the particular station to meet present needs under existing conditions is marginal at best.

It should also be noted, however, that even with completion of the designated rehabilitation work many of the stations, possibly excluding the Alewife Brook, East Boston Electric and Hingham pumping stations, will not conform to present engineering standards for wastewater pumping stations. This is because accepted practice for stations requires provision of separate wet and dry well sections in both substructure and superstructure, adequate access to wet wells, dry wells and equipment, adequate working areas around bar screens and equipment, wet wells designed to reduce septicity problems by minimizing retention times, isolated boiler installations, and adequate facilities such as cranes, hoists, etc. for removal of equipment. Many of these standards cannot be met unless the structural arrangement of the existing stations are extensively altered and/or expanded.

The following sections contain a brief description of the operational features of each of the 10 existing stations presently used together with brief comments on improvements needed and alternatives where appropriate. These descriptions are listed in alphabetical order. A detailed inventory of the pumping station equipment is presented in Appendix F.

Alewife Brook Pumping Station

As shown on Figure 6-1 (bound in back), this pumping station serves parts of Arlington, Belmont, Cambridge, Somerville and Medford.

It is one of the newer stations, built about 23 years ago, and, therefore, rehabilitation of the equipment listed in Table 6-2 should adequately bring the station to standards for handling of dry weather flows.

During the year 1971 the average daily pumping rate was 11.2 mgd (million gallons per day) and the maximum 24-hour rate was 45.3 mgd.

However, the Alewife Brook Pumping Station is operated at a rate of 90.6 mgd during times of storm runoff due to tributary combined sewers. Since this is the total installed capacity no standby pumping unit equal in capacity to the largest unit now in service is available at such times. Because of the configuration of the wet well and dry well, additional pumping capacity cannot be accomplished without expanding the wet well and dry well structures.

Another major difficulty in the operation of this pumping station occurs during rainstorms in that when the station is discharging at the rate of 90.6 mgd, the downstream sewer is surcharged and at times wastewater is discharged to the ground surface. Such discharges run across the ground to Alewife Brook. This situation can be remedied by providing a downstream relief sewer. It also can be remedied by eliminating the storm inflows to the pumping station by sewer separation or by combined sewer overflow regulation at selected points to handle any excess flows.

The work that will be required to properly rehabilitate this station can be best determined after detailed studies are made to determine the economics and possibility of effectively reducing the storm inflows to the station.

Braintree-Weymouth Pumping Station

This station pumps sewage from the Braintree-Weymouth Extension Sewer receiving sewage from Braintree, Hingham,

Randolph, Weymouth, and parts of Quincy into the South Metropolitan High Level Sewer discharging to the Nut Island Treatment Plant.

It contains three diesel engine driven direct connected horizontal single end suction sewage pumps. Each pump has a capacity of 20 mgd at 40 to 42 feet head and operates with a suction lift.

> Unit No. 1 consists of a 24 inch Morris Pump operating at 510 rpm (revolutions per minute), driven by a 6 cylinder 8-1/2 by 8-1/2 turbocharged Waukesha Engine installed in May 1972.
>
> Unit No. 2 consists of a 24 inch Worthington Pump operating at 510 rpm, driven by a 6 cylinder 9-1/2 by 10-1/2 normally aspirated Chicago Pneumatic engine installed in March 1970.
>
> Unit No. 3 consists of a 24 inch Worthington Pump operating at 505 rpm, driven by a 6 cylinder 8 by 10 Enterprise engine installed in August 1958.

Each unit drives a belt-connected 20 kw DC generator. All engine auxiliaries and all station equipment including the starting air compressors, vacuum pumps for priming, bar screen, and radiator fans are driven by DC motors. Radiators are mounted on a balcony remote from the engines. Two small 40 year old 6 kw engine generator units provide DC power when none of the three pumping units are in use. A 15 kva 100 ampere 120/208 volt, 3-phase, 4-wire alternating current power supply was installed in May 1973, for operation of a future screenings grinder. This replaced a 220 volt, single phase, 3-wire system formerly in use. At present, alternating current is used only for lighting.

Sewage enters the station through a mechanically cleaned bar screen set almost vertically in a deep, narrow channel which extends into the station underneath the pump room floor. The pump suction pipes extend into and draw from this channel. Pumps discharge vertically and then horizontally, all three pumps discharging into a single special double wye branch fitting within the station.

During the calendar year 1971, the average flow pumped per day was 14.1 mgd, and the maximum flow pumped in 24 hours was 29.3 mgd. On a normal day, one pump was operated about 20 hours at a speed varying from 400 to 500 rpm. When the sewage level in the incoming channel drops to Elevation 95 the pump is shut down and not started

again until the sewage level reaches Elevation 102.5. This usually happens several times a day, the aggregate downtime amounting to about four hours. The station, therefore, appears to have adequate capacity for present flows.

The station is old, of late 19th century or early 20th century design, but well maintained. The main pumping units are relatively new, having replaced earlier Winton engine pumps in 1958, 1970, and 1972.

It is unfortunate that all three engines are of different manufacture, and that the pumps are by two manufacturers. This is a result of piecemeal replacement of the equipment and the requirement that the award must go to the low bidder. It makes proper maintenance of the equipment much more difficult and costly, and makes it almost impossible to stock adequate spare parts. Under today's conditions in industry it can result in equipment being out-of-service for long periods waiting for replacement parts that formerly were available off-the-shelf.

The continuation of the antique DC electrical system is also a result of piecemeal replacement of equipment.

The bar screen has no bypass channel or duplicate unit. It is so situated in a deep channel with restricted openings that it cannot be raked by hand in case of emergency. Emergencies have occurred when all that could be done was to push the screenings down from the top to provide some utilizable screen area at a high level to keep the pumps running, and hope that the level would not rise high enough to back up into basements in the low-lying service areas.

The operating staff consists of 12 men to provide superintendance and round-the-clock attendance by an operator and an assistant. To operate the type of equipment installed, this staff is needed, and has performed creditably.

The cost of manual operation of attended stations is great in relation to that of automated equipment and can seldom be justified. The payroll approximates $2,000 per week, not counting fringe benefits, or $104,000 per year. Since the sewage could be pumped electrically by 900,000 kw hours of energy, the labor cost alone is equivalent to 11.5 cents per kw hour. In addition, approximately 55,000 gallons of diesel fuel, 300 gallons of lube oil, and engine maintenance services are required.

An additional inlet channel and bar rack are needed immediately regardless of future alternative developments.

As an alternative to the station improvements listed in Table 6-2, consideration should be given to the construction of a new automatic unattended electric station with standby generating or pumping capacity remotely controlled by telemetry. This new station could be located adjacent to the existing station utilizing the existing influent channel and the existing and proposed bar racks to the extent found feasible.

Conversion of the existing station is automatic operation comparable to that just described for a new station is another alternative. This would require most of the improvements listed in Table 6-2 as well.

Charlestown Pumping Station

This station lifts the sewage from Charlestown and portions of Cambridge, Somerville and Medford from a tunnel crossing under the Mystic River to a gravity intercepting sewer system leading to the Chelsea Headworks. The flow includes areas served by combined sewers. This station contains three pumping units consisting of diesel engines driving vertical shaft centrifugal pumps through right angle gears.

Units No. 1 and 2 consist of 36 inch Fairbanks-Morse bottom suction angle flow pumps rated at 45 mgd each at 11 foot head and 240 rpm driven by 175 hp. Fairbanks-Morse diesel engines Model 31A 6-1/4 S, rated 600 rpm.

Unit No. 3 consists of a 42 inch Fairbanks-Morse bottom suction angle flow pump driven by a Fairbanks-Morse 6 cylinder opposed piston diesel engine, Model 38F 5-1/4, rated 270 hp. at 720 rpm. The pump nameplate indicates the capacity as 35,000 gpm (50 mgd) at 17 foot head and 191 rpm. However, the 53rd annual report lists the capacity as 60 mgd at 18 foot head. We believe the latter rating is correct, since the right angle gear has a speed reduction ratio of 3.45 to 1 which would make the pump speed 208 rpm for a rated engine speed of 720 rpm, and the engine has sufficient capacity to operate the pump at this speed.

The pumps are located in individual circular pump pits with deep suction conduits taking off horizontally

from the influent tunnel and rising vertically beneath the pumps. Each suction conduit is supplied with a sluice gate which is practically inaccessible and at present cannot be operated. Each pump discharge is provided with a swing check valve but no gate valve. During the inspection of this station, the flapper had failed on Unit No. 1 and had been removed. A DeZurik knife valve was being installed to serve as a stop valve, and similar valves were planned for Units 2 and 3.

Each engine drives a belt connected DC generator, rated 20 kw on Units 1 and 2, and 30 kw on Unit No. 3. In spite of the fact that the station is located in the shadow of the huge Mystic Station of the Boston Edison Company, there is no AC power in the station and no public power connection.

Bar screens are of the cage type.

During the calendar year 1971 the average quantity pumped per day was 64 mgd and the maximum quantity pumped per day was 108 mgd. Since the peak hourly rate would be somewhat greater, it is obvious that the station does not have the capacity to pump peak flows as they arrive with any one unit out of service, let alone the largest unit. When a unit is out of service at peak flows, the sewage temporarily backs up in the incoming sewer.

The Charlestown Pumping Station serves combined sewers. Therefore, at times of storm runoff, the operating personnel usually operate all of the pumps within the station at a total discharge rate of approximately 140 mgd. At such times, the downstream sewer is normally surcharged.

Alternatives of reducing the storm inflows into this station must be studied. It is reported that a large portion of the combined sewer system in Charlestown will be separated under redevelopment. In addition to separation, consideration should be given to combined sewer overflow regulation by chlorine detention treatment systems. Such a system could be located on the south bank of the Mystic River downstream from the pumping station. Detailed studies and investigations should be undertaken to determine the best alternative solution.

The station is old. The present pumps replaced original steam engine driven units. Units No. 1 and 2 are approximately 18 years old and are in only fair condition. Unit No. 1 has been in operation 74,000 hours or 47 percent

of the time. Unit No. 2 has been in operation 83,000 hours or 53 percent of the time. Engines are an obsolete model, no longer in production. Unit No. 3 is 12 years old and has been in operation 53,500 hours or 51 percent of the time. Its condition was reported as only fair. Replacement parts have increased almost fivefold in price since the first order following installation and are no longer available off-the-shelf. Furthermore, they are manufactured only about once a year, resulting in long waits for essential parts.

The bar screens are old, must be raised and cleaned manually, and one of them will not go down all the way.

The pumps operate under a positive suction head. Access manholes to the sluice gates are deep and flooded, and the manhole steps are badly corroded, some missing entirely. To work on the pumps it is necessary to pump the sewage down and fasten a plate over the suction opening after removing the pump. Divers have been employed to assist in this operation to install temporary plugs in the suction lines. A diver was employed to put No. 3 sluice gate in operation but it was discovered subsequently that the guide grooves had become filled with a hard substance and the gate still could not be operated.

Failure of the check valves has posed a serious problem since, in the absence of discharge gate valves, the pumped flow can recirculate back to the suction through an idle pump. A DeZurik knife valve, pneumatically operated, is being installed on No. 1 unit. This is the only type of valve with a short enough laying length to fit in the available space. This valve will serve satisfactorily by opening it after a pump has been started and closing it just before a pump is shut down. Similar valves are proposed to be installed in the discharge of Units 2 and 3.

The operating staff, consisting of about 12 men, and the maintenance department have done a remarkable job keeping this station in operation under unusual difficulties due to the design and age of the station and its equipment.

The pneumatically operated knife valves should be installed as planned on all three pump discharge lines.

As an alternative to the rehabilitation program indicated in Table 6-2, the construction of a new electric station should be considered. Since the pumping station is

located on a very limited site which cannot be readily expanded to provide space for a new installation, a new facility is probably better located on the south bank of the Mystic River. This location would require the construction of force mains across and under the Mystic River to the sewer downstream of the existing pumping station. Because of the conditions under which this construction must be made, the cost of providing these force mains will be relatively high.

East Boston Steam Pumping Station

As shown on Figure 6-2, this station pumps sewage from areas of East Boston and Orient Heights plus flow normally tributary to the Chelsea Headworks but diverted to the siphon under Chelsea Creek by throttling of the inlet gates in the Headworks. Before construction of the tunnel to Deer Island, this station, in combination with the East Boston Electric Station, handled almost the entire flow from the North Metropolitan District. Throttling of the flow at the Chelsea Headworks diverting sewage to this station is normally due to the failure of the pumps at the Deer Island Main Pumping Station to pump their design flow. This station discharges sewage through the old North Metropolitan Sewer from which it is diverted to the Winthrop Terminal Facility for pumping into the Deer Island Treatment Plant.

Since the East Boston Steam Pumping Station serves the East Boston combined system, it receives large quantities of storm runoff at times of heavy rainfall. Because this station and the East Boston Electric Pumping Station in addition are required as standby to handle excess flows from the Chelsea Headworks, sufficient capacity must be maintained at these installations under present operating plans.

This pumping station is a tremendously large, old-fashioned brick station, built about 1898, with two tall stacks and four circular pump pits containing centrifugal pumps operating with flooded suctions.

> Pumps No. 2 and 3 are driven by the original horizontal triple expansion steam engines and are rated 45 mgd each at 19 foot head. One of these pumps was operating during our visit to the station, and has ample capacity for the dry weather flow now received at the station. The other pump driven by a similar engine has been inoperable for many years.

Pump No. 1 is driven by a uniflow steam engine approximately 23 years old through a right angle gear. The unit is rated 60 mgd at 24 foot head and operates on 130 psi gage steam pressure and 26 inch vacuum.

Pump No. 4 is driven by a 750 hp 12 by 15 Enterprise diesel engine, Model DSG-8, through a right angle gear and is rated 100 mgd at 19 foot head. Bar screens are of the manually cleaned cage type.

Three comparatively new Cleaver Brooks package boilers provide steam for the plant.

Electricity is generated by steam engine driven generators. The open type switchboard is antiquated and does not meet present day standards.

The building also houses maintenance shops of the MDC.

The operating staff consists of 14 men. This provides for a Second Class Power Plant Engineer and a Steam Fireman on each shift, 24 hours per day, and a Chief and an Assistant Chief Power Plant Engineer and three laborers on the daylight shift.

Whether the East Boston Steam Pumping Station should be replaced will require studies to determine the future role of this station within the Metropolitan District system. If such a study should indicate that the East Boston Steam Pumping Station is best used to serve only the needs of East Boston, then it will probably be best to replace this station with a small modern-type installation. In this event, the East Boston Electric Pumping Station would be rehabilitated to handle all excess flows from the Chelsea Headworks.

On the other hand, if the East Boston Steam Pumping Station is to be used to handle excess flows from the Chelsea Headworks, then it may not be economical to replace this station with a new facility. This is because the 60-inch connections from the Chelsea Headworks have been extended to the East Boston Steam Pumping Station and to relocate them to a new facility will be very costly.

It is, therefore, evident that this matter requires further investigation before it can be determined if the East Boston Steam Pumping Station should be replaced by a new facility or rehabilitated.

East Boston Electric Pumping Station

This station was installed about 1938 to supplement the capacity of the East Boston Steam Station. Overflows from the Chelsea Headworks reach this station through two siphons passing under Chelsea Creek and the pumped sewage can be discharged to Chelsea Creek through two sluice gates as well as to the North Metropolitan Sewer leading to the Deer Island Treatment Plant. Reportedly it has not been necessary to discharge sewage to Chelsea Creek for the last eight years.

This station contains two deep vertical sewage pumps operating with flooded suctions and driven by electric motors located at ground level.

> Pump No. 1 is a De Laval centrifugal sewage pump rated 75 mgd at 38.5 foot head driven by a direct connected 600 hp General Electric 4,000 volt motor at a speed of 320 rpm.
>
> Pump No. 2 is a De Laval centrifugal sewage pump rated 50 mgd at 38.4 foot head driven by a 400 hp General Electric 4,000 volt motor at a speed of 394 rpm.

The switchboard is comparatively modern.

The station was designed to operate automatically but is now operated manually.

Bar screens are housed in an unsightly timber structure on the other side of Chelsea Creek in the yard of the Chelsea Headworks. Discharge gate valves, 36 inches and 42 inches in size, are located 40 feet above the pumps and are provided with Limitorque operators. Vacuum pumps are provided for exhausting air from the discharge line between the pumps and the gate valves before starting the motors in order to eliminate the possibility of waterhammer.

The sluice gates which permit discharge to Chelsea Creek are manually operated by hand cranks.

The screen house and screens are in poor condition. Brakes, chains and sprockets are badly worn; housings including electric motors are badly corroded. No ventilation or heating is provided. Railings around screen openings are dangerously corroded. Explosionproof lighting fixtures have been replaced by ordinary nonexplosionproof lights.

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Equipment, piping, pipe supports and conduits located in the pump room are badly corroded. The sump pump is in poor condition.

Some fastenings for electrical boxes have rusted away and the boxes are tied and hanging from other piping whose fastenings have rusted away also.

Lighting conduits in the pump pits have rusted extensively.

Pumps and motors are of modern design and suitable for many more years of service.

Continuous attendance should not be needed, since the station was designed to operate automatically. However, when emergency operation of the pumps is required an operator could be dispatched from another facility if necessary.

Corrosion damage should be corrected by repairs or replacement and equipment painted.

The screen house superstructure should be replaced by a modern fireproof facility with explosionproof electrical equipment. The bar racks should be completely reconditioned or replaced.

Additional improvements are listed in Table 6-2.

Hingham Pumping Station

The Hingham Pumping Station pumps sewage from the North Hingham Sewer District to the Braintree-Weymouth Extension Sewer via a long force main.

The Hingham Pumping Station is one of the newer pumping stations within the Metropolitan District and generally conforms to present engineering design standards. Provision has been made at this pumping station for adding an additional pumping unit when additional capacity is required. The existing equipment is in good condition and accordingly requires a minimum of rehabilitation work. For these reasons, this station with modification to the existing pumping capacity can be readily revamped to meet 2000 needs. The present force main is inadequate to handle 2000 flows and will require relief.

Houghs Neck Pumping Station

This is a small MDC pumping station serving the section of Quincy near the High Level Sewer and the Nut Island Treatment Plant.

The station itself is very old. However, its pumping equipment has been upgraded recently. To minimize the requirements for operating personnel, this station was originally equipped with a relatively large wet well of horseshoe-shaped construction. These large wet wells permitted the storage of the incoming wastewater during low flow periods, which was pumped out of the system during the daylight hours when personnel were in attendance at the station. For this reason, the modernization of the wet well arrangement is proposed in Table 6-2 along with several other improvements.

Quincy Pumping Station

This station pumps sewage from portions of Quincy into two force mains about three fourths of a mile long leading to the High Level Sewer.

This station is quite similar to the Braintree-Weymouth station. It contains three diesel engine driven direct connected horizontal single end suction sewage pumps operating with a suction lift.

> Units No. 1 and 2 each consist of a 20 inch Fairbanks-Morse pump driven by a 170 hp Fairbanks-Morse 31 A 6-1/4 S diesel engine. Each pump is rated at 20 mgd at 33 foot head at 600 rpm.
>
> Unit No. 3 consists of a 20 inch Worthington pump driven by a 66 hp, 3 cylinder 8 by 10 Enterprise diesel engine, Model DSM3. The unit has a rated capacity of 12 mgd at 26 foot head at 500 rpm.

Engines are radiator cooled with attached circulating water pumps and radiators mounted integrally with the engines. Radiator fans are belt driven from the engines. Auxiliaries consist of two electric motor driven starting air compressors and one electric motor driven and one gasoline engine driven vacuum pump. Electricity is supplied by the power company. Formerly single phase, this has been changed recently to a 15 kva 120/208 volt, 3-phase service.

Sewage enters the station through a back cleaned mechanical bar rack located in the basement. A new channel

and bar rack with the operating floor at ground floor level is being installed. Pumps discharge vertically and then horizontally, all three pumps discharging into a single special double wye branch fitting within the station. The plans show two force mains from the station to the high level sewer, one 30 inch and the other 24 inch in diameter.

During the calendar year 1971, the average flow pumped per day was 10.13 mgd, and the maximum flow pumped in 24 hours was 20.01 mgd. The maximum output with all three pumps in operation was said to be 28 mgd, due to head losses in the discharge lines.

The building is old, but appears to be well maintained. Units No. 1 and 2, the Fairbanks-Morse units, were installed in 1950 and have been in operation 60,000 hours each or 30 percent of the time per unit. In other words, assuming only one 20 mgd pump were operated at one time, this would have occurred 60 percent of the time. Unit No. 3, the 12 mgd unit, was installed in 1957 and has been in operation 80,000 hours, or approximately 57 percent of the time. It is said to be in good condition.

One Fairbanks-Morse engine was recently overhauled and the other is due for an overhaul. Both 20 mgd pumps were overhauled in 1969. The starting air compressors are also of Fairbanks-Morse manufacture and are said to be in poor condition with no replacement parts on hand. The Fairbanks-Morse diesel engines are an obsolete model and replacement parts may be hard to get. It is now impossible to obtain replacement parts off-the-shelf, and such parts on order are entered for production only when enough accumulate for a production run at a good profit. This may mean a wait of six months or more, with standby or essential equipment unavailable, unless the necessary parts are stocked by the MDC or can be manufactured by independent machine shops.

Due to the type of pumping equipment, continuous round-the-clock attendance is required, since starting and stopping of units, control of speed, and priming of pumps must be done manually. Even the charging of the starting air storage tanks is a manual operation since automatic pressure switches were not installed.

The diesel engine for Unit No. 1 should be overhauled and put in good condition. In addition, the starting air compressors should be put in improved operating condition. If the necessary parts cannot be obtained from Fairbanks-Morse in a reasonable time, a new starting air compressor should be purchased.

Adequate electric lighting should be provided for the starting air compressor and vacuum pump areas.

The immediate improvements to be considered are listed in Table 6-2.

For the long range an alternative study of conversion of this pumping station to an automatic, unattended electric station should be made. It would include automatic standby generating or pumping capacity as well as telemetering for remote supervisory control.

In conjunction with this study, the hydraulics of the two force mains should be analyzed to insure that future peak-flows can be pumped with one of the largest units out of service.

Reading Pumping Station

This station serves the Town of Reading and lifts sewage from a large concrete tank a height of 48 feet with tank full or 62 feet with tank drawn down and discharges through a 16 inch force main 1,400 feet long passing under Route 128 and emptying into the Reading Extension Sewer.

The station contains two vertical shaft nonclog sewage pumps located in a pump room approximately 16 feet square with floor 44 feet below ground level, and 34 feet below basement level. Pumps operate with a positive head on the suction varying from one to 15 feet. Motors are located at ground floor level. Suction and discharge gate valves are operated by floor stands at the basement level. Cage type bar screens can be raised to basement level for manual cleaning.

Unit No. 1 consists of an 8 inch Fairbanks-Morse bottom suction nonclog pump rated 4 mgd at 80 foot head driven by a 100 hp 865 rpm G.E. wound rotor motor. The unit is started and controlled manually and is operated only at full speed.

Unit No. 2 consists of an 8 inch Morris bottom suction nonclog pump rated 4 mgd at 75 foot head with dual drive consisting of a Fairbanks-Morse two cycle diesel engine, Model 49A 4-1/2 6S rated 120 hp at 1,200 rpm driving through a right angle gear on top of which is mounted a 100 hp 1,170 rpm 440 V 3-phase squirrel cage electric motor made by Fairbanks-Morse. Change-over from electric drive to engine drive and vice-versa requires manual shifting of a clutch collar and takes one man 20 to 30 minutes. The electric motor is provided with a manual lever operated reduced voltage starter.

Alternating current is supplied by the Reading Municipal Light & Power Company.

The pump room is reached from the basement level by three flights of vertical ladders interrupted by two intermediate platforms.

During the calendar year 1971 the average flow was 2.31 mgd and the maximum flow pumped per day was 4.01 mgd. On many occasions, water rises in the sewers above the crown of the pipe and residents complain of slow flushing toilets. Sanitary sewage flows are increasing; during the last five years the pumps' operating time has tripled.

The above flows are estimated, since the station does not have a flow meter. With the minimum static head and a full collection reservoir it is probable that the peak pumping rate of one pump is considerably greater than 4 mgd.

The station was built in 1920. The structure appears to be in good condition. The station has no emergency lighting system and battery operated flashlights must be used during night-time power outages. With only one operator on duty, this makes it considerably more difficult to connect the diesel engine and get it in operation.

The electric switchboard contains open knife switches and represents a danger to the operator and others having business at the station, in case of accidental contact. Pump motor starters are manual type lever operated. The resistor bank for the wound rotor motor is located in the basement, which is badly cluttered up. The electrical installation is not up to present day standards of safety, reliability and convenience.

The diesel engine is an obsolete model and replacement parts may be difficult to obtain.

Pump No. 2 is in operation without wearing rings. A new pump has been received as a replacement and is due to be installed soon.

The screen room hoists and lighting should be explosionproof, but are not. The light is operated by a pull chain. The cage type bar racks are badly corroded and the hoists in poor shape. Screenings amounting to 3 to 6 cubic feet per day are placed in barrels and carried up the rear entry to the basement level.

The operator reports a considerable buildup of grease or scale on the inside of the discharge piping at the pumps.

The 16 inch discharge pipe rises vertically from the pump room to the basement level within the concrete wall of the station. In the basement it turns to a horizontal direction and runs as bell and spigot pipe about 4-1/2 feet above the floor to exit from the station. Several years ago, it was noticed that the 16 inch 90 degree bell and spigot elbow at the top of the vertical rise had pulled one inch out of its socket, after which the joints were strapped. The exact time and operational incident which caused the joint to pull apart was not observed or determined.

A 6 inch riser pipe from the pump discharge to the basement level is supposed to be kept full of air from an air compressor in the basement to serve as a surge suppressor since the discharge piping could be subject under certain conditions to severe waterhammer pressures. In our opinion, this arrangement is not fully effective.

When Route 128 was constructed, 500 feet of 16 inch pipe was installed to serve as a future duplicate force main from the station. This pipe has not yet been placed in service.

The station is heated by an oil fired steam boiler. The operator reports inadequate heat in the wintertime.

The operating staff consists of a superintendant and four operators for round-the-clock station attendance. This means that at nights, and occasionally on days, only one

operator is on duty. In case of an accident, this man would be helpless until his relief arrived. During the periods when only one operator is on duty, an hourly police check by telephone or squad car should be instituted.

Improvements needed are summarized in Table 6-2. Replacement of Pump No. 2 should be carried out as planned along with increase in pumping capacity. Extension of the duplicate force main under Route 128 to the full 1,400 feet in length should be made and the existing main should be put in service for increased capacity and reduced head losses.

Also, a plan should be developed to rehabilitate the station for automatic control of a modern installation of three electric driven pumps to handle future peak flows with one unit out of service. Automatic lead front electrical controls, and new screens should be included. Water-hammer conditions for power failure with two pumps operating at minimum suction level, including water column separation at the top of the discharge riser, should be studied to insure proper protective measures.

The alternative of a new automatic electric station should also be studied.

Squantum Pumping Station

This pumping station pumps sewage from the Squantum section of Quincy to the MDC High Level Sewer through a long force main.

The pumping station is very old and originally pumped sewage to the nearby Boston Main Drainage Works. However, with the abandonment of Boston's Moon Island facilities, diversion to the Nut Island Treatment Plant was necessary.

The capacity of the Squantum Pumping Station will need to be appreciably increased to meet year 2000 needs. The space available for additional pumping equipment is extremely limited and will require the expansion of the present dry well portions of the structure if additional pumping equipment is to be properly accommodated. Given the age of these facilities, the limitations and condition of the equipment, replacement of this pumping station with new facilities of appropriate capacity and designed to meet current engineering standards would appear warranted. Preliminary site investigations indicate that suitable areas near the existing facilities are available for new construction.

Costs of Recommended Improvements

Improvement needs for each of the pumping stations are listed in Table 6-2.

Estimated costs for the rehabilitation or replacement of the pumping stations are shown in Table 6-3.

TABLE 6-3. ESTIMATED COST FOR REHABILITATION OR REPLACEMENT OF MDC PUMPING STATIONS

Pumping station	Work	Estimated cost
Alewife Brook	Rehabilitate	$ 712,000
Braintree-Weymouth	Replace	2,920,000(1)
Charlestown	Replace	6,000,000(1)
East Boston Steam	Replace	1,460,000(2)
East Boston Electric	Rehabilitate	365,000
Hingham	Rehabilitate	890,000
Houghs Neck	Replace	203,000
Quincy	Replace	2,220,000(1)
Reading	Replace	3,042,000(1)
Squantum	Replace	1,350,000

1. Includes necessary force mains.
2. Based on serving East Boston only.

Costs are based on January 1975 costs for the Boston area at General Construction Engineering News Record (ENR) cost index of 2200.

All costs relating to the repair, rehabilitation or reconstruction at pumping facilities include the cost of materials, labor, installation, testing, engineering and an allowance of 50 percent for contingencies.

CHAPTER 7

HEADWORKS ANALYSIS AND IMPROVEMENTS

General

The following existing headworks are discussed in detail in this chapter:

Chelsea Creek	Ward Street
Columbus Park	Winthrop Terminal Facility

All of these facilities are of recent design and construction. The Chelsea Creek, Columbus Park, and Ward Street headworks were placed in operation in 1968, and the Winthrop Terminal Facility was placed in operation in 1970. All of these facilities provide pretreatment -- coarse and fine screening, and grit removal -- for the wastewaters discharged to the Deer Island Treatment Plant. The Chelsea Creek Headwork is connected to the Deer Island main pumping station by a deep rock tunnel approximately four miles in length. The Columbus Park and Ward Street headworks are connected to the same pumping station through a separate deep rock tunnel approximately seven miles long. The Winthrop Terminal Facility is located on the site of the Deer Island Treatment Plant and is designed to normally discharge wastewaters directly to the primary sedimentation tanks of that facility.

Appendix G presents an inventory of major equipment in each of the headworks.

Description of Facilities

The Chelsea Creek, Columbus Park and Ward Street headworks contain bar racks and grit collectors for pretreatment of the wastewater before it is discharged to the Deer Island Treatment Plant. At each installation, the flow through each grit chamber is measured by a Parshall flume which permits velocity control in each grit chamber. The Columbus Park and Ward Street headworks are equipped with both coarse and fine bar screens. However, operating experience has indicated that the coarse bar screens are not required, and it is anticipated that they will be removed in the near future. Flow through the headworks is by gravity.

Wastewater entering the Winthrop Terminal Facility passes through coarse and fine bar racks and is pumped to a

Parshall flume, then flows by gravity through aerated grit chambers to the Deer Island Treatment Plant. With completion of the installation of two 60-mgd pumps that have been moved from the old Deer Island Pumping Station, this facility has an installed pumping capacity of 180 mgd. The discharge piping from the two 60-mgd pumping units is designed so that these pumps may discharge either to the grit chambers or to the treatment plant bypass conduit. Flows that are discharged to the treatment plant are measured by the Parshall flume.

Particulars relating to the principal equipment at each of the headworks is presented below:

<u>Chelsea Creek Headworks</u>

4 - Fine bar screens 12 feet-0 inches wide by 10 feet-9 inches deep.

8 - Grit collectors, two in each of four channels.

8 - Inclined screw conveyors, two in each of four channels, 16-inch diameter, 8-inch pitch screw, capacity of 2 cubic yards per hour at 15 rpm (revolutions per minute).

4 - Horizontal screw conveyors, one in each of four channels, 12-inch diameter, 12-inch pitch screw, capacity of 4 cubic yards per hour at 4 rpm.

4 - Grit ejectors, pneumatically controlled, capacity of approximately 30 cubic feet at 100 psi (pounds per square inch).

1 - Grit storage hopper.

<u>Columbus Park Headworks</u>

4 - Coarse bar screens 8 feet-0 inches wide by 8 feet-7 inches deep, mechanically cleaned, 3-1/2-inch clear opening.

4 - Fine bar screens 10 feet-6 inches wide by 8 feet-11 inches deep, mechanically cleaned, 3/4-inch clear opening.

8 - Grit collectors, two in each of four channels.

8 - Inclined screw conveyors, two in each of four channels, 16-inch diameter, 8-inch pitch screw, capacity of 2 cubic yards per hour at 15 rpm.

4 - Horizontal screw conveyors, one in each of four channels, 12-inch diameter pitch screw, capacity of 4 cubic yards per hour at 4 rpm.

4 - Grit ejectors, pneumatically controlled, capacity of approximately 30 cubic feet at 100 psi.

1 - Grit storage hopper.

4 - Screenings ejectors, pneumatically controlled, capacity of approximately 12 cubic feet at 100 psi.

1 - Screening storage hopper.

Ward Street Headworks

4 - Coarse bar screens 8 feet-0 inches wide by 9 feet-1 inch deep, mechanically cleaned, 3-1/2-inch clear opening.

4 - Fine bar screens 10 feet-6 inches wide by 9 feet-4 inches deep, mechanically cleaned, 3/4-inch clear opening.

8 - Grit collectors, two in each of four channels.

8 - Inclined screw conveyors, two in each of four channels, 16-inch diameter, 8-inch pitch screw, capacity of 2 cubic yards per hour at 15 rpm.

4 - Horizontal screw conveyors, one in each of four channels, 12-inch diameter, 12-inch pitch screw, capacity of 4 cubic yards per hour at 4 rpm.

4 - Grit ejectors, pneumatically controlled, capacity of approximately 30 cubic feet at 100 psi.

1 - Grit storage hopper.

4 - Screenings ejectors, pneumatically controlled, capacity of approximately 12 cubic feet at 100 psi.

1 - Screening storage hopper.

Winthrop Terminal Facility

3 - Coarse bar screens 4 feet-0 inches wide by 9 feet-6 inches deep, mechanically cleaned, 3-1/2-inch clear opening.

3 - Fine bar screens 4 feet-0 inches wide by 9 feet-6 inches deep, mechanically cleaned, 3/4-inch clear opening.

2 - Elevating grit collectors, one in each of two chambers.

1 - Horizontal grit screw conveyor 9-inch diameter, capacity of 200 cubic feet per hour.

1 - Screening discharge hopper, capacity of approximately 12 cubic feet.

4 - Electric driven, vertical nonclogging, single end suction, centrifugal or mixed flow-type pumps, each with a capacity of 10,400 gpm (gallons per minute) at 600 rpm against a total dynamic head of 30 feet.

2 - Diesel-driven pumps, each capable of pumping 60 mgd (presently being installed).

3 - Aeration blowers 75 hp, 550 rpm, each having a capacity of 1,700 cfm (cubic feet per minute).

2 - Grit chamber blowers 15 hp, 900 rpm, each having a capacity of 100 to 270 cfm.

2 - Ejector air compressors 25 hp, 870 rpm, two-stage, three-cylinder, 142-cfm piston displacement.

Operating Data

A summary of operational data for each of the head-works covering the period July 1, 1971 to June 30, 1972 is presented in the following table:

TABLE 7-1. HEADWORKS PRETREATMENT FLOW DATA

Flows, mgd	Chelsea Creek	Columbus Park	Ward Street	Winthrop facility	Totals
Minimum hourly rate	62	22	30	0	
Minimum 24 hours	86	55	67	1	
Average daily	146(1)	77(1)	101	5	329
Average daily (Design)	(140)	(66)	(113)	(24)	(343)
Maximum 24 hours	266	150	170	23	
Maximum hourly rate	330	205(1)	280	53	
Maximum hourly rate (Design)	(350)	(182)	(256)	(60)	
Total for year, mil gal	53,473	28,098	36,882	1,770	120,223

1. Higher than design flow due to inflow, especially salt water inflow (see Technical Data Vol. 2).

The inspection of the Chelsea Headworks indicated that the back-cleaned bar screen wiper bars need adjustment or redesign to provide a metal to metal shearing action to prevent screenings being carried over the top and washed off behind the screen. As estimated, 15 percent of the screenings bypass the bar racks in this manner.

When visited, only one (of the four) grit chambers was in operation, handling a flow of 125 mgd. The estimated velocity in the grit chamber was in excess of one foot per second. The screw conveyors indicated no grit was being removed, but, of course, most of the grit is collected at times of storms. However, it was noted that the rate of grit removal at this location decreased from 0.76 cubic feet per million gallons in 1971 to 0.56 cubic feet per million gallons in 1972. This compares with decreases at the other headworks of less than 5 percent between the same years.

Rehabilitation Needs

Since the Winthrop Terminal Facility is of very recent construction, this facility has no need for any rehabilitation work.

All of the headworks are of modern design and are in conformance with sound engineering practice. However, due to the functions that they perform, the equipment within them is subjected to very abrasive action by grit and corrosive action by sewage. Accordingly, it can be anticipated that the need for equipment repair will occur frequently, and correspondingly, the maintenance budget for the headworks should be made adequate to provide for these needs.

Inspection of the headworks indicate that the fine screen cleaning mechanisms, the inclined and horizontal grit collectors and the grit ejectors and valves associated with them are in need of repair at all of the facilities.

At all of the headworks, difficulties have been experienced with the pneumatic grit ejection systems because of rapid erosion of the discharge piping, particularly at bends; line stoppages, and the disposition of grit at valve locations. Because of the general operational difficulties that have been experienced with these systems, it would appear warranted to review the design of these facilities, and to determine if the piping is of suitable material for this type of service. Based on this review, alterations might be suggested which would help in minimizing the difficulties now experienced.

Screenings at the Ward Street Headworks are conveyed pneumatically to a hopper from which the screenings are trucked to Deer Island for landfill disposal. Since the pneumatic system at Columbus Park is not used due to the condition of the ejectors, the screenings are bagged before they are trucked to Deer Island. At the Chelsea Headworks, the screenings are manually collected and loaded on a truck for disposal at Deer Island. The present operational situation indicates that there is some need for repairs, and perhaps, a review of the operational procedures to determine the most feasible method of collecting the screenings at each headworks.

Capacity Requirements

Five conceptual plans have been investigated to determine the best method of providing for the future sewerage needs of 109 Eastern Massachusetts Metropolitan

Area communities. However, interceptor, pumping station and headworks improvement requirements are identical in Concepts 4 and 5. Under these concepts, the existing limits of the Deer Island service area will be either expanded slightly or undergo varying degrees of contraction. Correspondingly, the total service area tributary to the headworks vary. Therefore, the total future design capacity requirements for the headworks vary depending on the conceptual plan under consideration.

Table 7-2 sets forth for each of the headworks the present design capacity of the facility and for each conceptual plan the estimated capacity requirements for 2000. The capacity requirements are based on peak dry weather flows that are expected to occur by 2000.

It is to be noted that the estimated peak 2000 dry weather flows presented in Table 7-2 for the Columbus Park Headworks and the Winthrop Terminal Facility remain constant under all conceptual plans because the tributary areas to these facilities do not vary. The estimated peak 2000 dry weather flows do vary in the case of the Chelsea Creek and Ward Street headworks, and are at a maximum under Concepts 1 and 3.

Under the Recommended Plan, flows tributary to the headworks facilities are similar to those under Concepts 1 and 3 as shown.

Comparison of the design capacity of each headworks with the estimated 2000 capacity requirements indicates that each headworks, with the exception of Ward Street, has sufficient design capacity to handle estimated 2000 peak dry weather flows. Although the design capacity of the Ward Street Headworks is given as 256 mgd, this facility has been reported to have operated satisfactorily at rates of flow up to 285 mgd. Based on this operational experience, the Ward Street Headworks appears to have sufficient capacity for the projected year 2000 needs.

The estimated 2000 peak flows given in Table 7-2 for the Winthrop Terminal Facility assumes that the service area for that facility will be limited to Winthrop, Orient Heights, and East Boston. However, as noted in the previous chapter, at times an excess of 100 mgd may be diverted to this facility from the Chelsea Headworks through the East Boston Steam or Electric pumping stations. At such times, the Winthrop Terminal Facility would be required to handle flows up to the reported capacity of the North Metropolitan Trunk Sewer or on the order of 100 to 125 mgd. With the two 60-mgd pumps now being installed, there will be sufficient pumping capacity to handle flows of this magnitude, with the largest pumping unit out of service. The grit

TABLE 7-2. FUTURE CAPACITY REQUIREMENTS FOR HEADWORKS UNDER PEAK DRY WEATHER FLOWS - FOR THE YEAR 2000

Headwork	Peak design capacity, mgd	Capacity requirements year 2000 peak dry weather flows, (mgd)				
		Concept 1	Concept 2	Concept 3	Concept 4	Recommended plan
Chelsea Creek	350	350	350	350	194	350
Columbus Park	182	176	176	176	176	176
Ward Street	256	264	189	264	189	264
Winthrop Terminal Facility	60 (1)	25	25	25	25	25

1. Total installed pumping capacity 180 mgd.

chambers, which have a design capacity of approximately 60 mgd, are located downstream of the pumping station and are not designed to handle the total installed capacity of the pumping facility. This is because it is planned to divert, after pumping, any excess flow beyond 60 mgd to the bypass conduit rather than routing any excess flow through the grit chambers and the treatment plant. It is doubtful that bypassing of excess flow wastewaters will be acceptable to the regulatory agencies. For short-range planning, grit removal and chlorination treatment facilities should be provided for any excess flows. For long-range planning, consideration should be given to routing all flows from the Winthrop Terminal Facility to the Deer Island Treatment Plant when the treatment plant is expanded to meet future needs. These recommendations are contingent on the fact that future studies will indicate that diversion of excess flows to the Winthrop Terminal Facility from the Chelsea Headworks through the East Boston Pumping Stations and the North Metropolitan Trunk Sewer is recommended.

Although each of the headworks is estimated to have sufficient capacity to meet 2000 peak dry weather flow needs, under present conditions they do not have sufficient capacity to handle peak inflows. This is because they all receive large quantities of storm inflow since they serve extensive combined sewered areas. The situation at some of the headworks is further aggravated by the saltwater inflow that is received due to faulty operating tide gates. However, this situation is now being corrected through a tide gate repair and replacement program which is discussed in Technical Data Vol. 2.

Presently, excess flows tributary to the Ward Street and Columbus Park headworks up to the capacity of the existing systems back up in the Charles River Valley Sewer or in the Columbus Park connection to Boston's Dorchester Interceptor. At such times, the excess flow in the Charles River Valley Sewer up to the capacity of the existing system is diverted to the B.U. storm detention and chlorination station temporary storage or for treatment before discharge to the Charles River. When the depth of flow in the Columbus Park Headworks connection reaches an excessive level, the Calf Pasture Pumping Station is placed in operation and excess flow up to its capacity is diverted to a large sewer and thence to the Moon Island tanks by gravity. At Moon Island, these flows are intended to be stored and discharged only during the outgoing tide. As previously noted, excess flows at the Chelsea Creek Headworks up to the capacity of the North Metropolitan Trunk Sewer are diverted to the Winthrop Terminal Facility. Inflows to

the various sewers beyond the capacity of the above systems overflow into various receiving waters through the numerous combined sewer overflows as discussed in Technical Data Vol. 7.

It would be very costly to increase the capacity of the headworks to provide for peak storm inflows. This is because the headworks, tunnels and the Deer Island Treatment Plant into which they discharge have been designed to operate integrally, handling only flows slightly greater than peak dry weather flows. To increase the design capacity of the headworks for all inflows would require a large increase in capacity of the tunnels which serve them. Furthermore, it is not likely that elimination of inflows by complete separation of the combined systems that are served by the headworks will be economically and environmentally justifiable. For these reasons, it would seem prudent to continue the present mode of operation of these facilities at times of storm inflow until combined sewer overflow regulation plans are implemented. However, the existing facilities of the Calf Pasture Pumping Station should be upgraded to provide modern mechanically cleaned racks and grit chambers ahead of the pumping station, and the storage tanks at Moon Island should be equipped with skimming and chlorination facilities. The Winthrop facility should also be upgraded to provide facilities that will permit degritting and disinfection of all flows that pass through that facility, if studies indicate that excess flows should be diverted to that facility.

For long-range planning, excess flows should be handled as part of the overall combined sewer overflow regulation plan.

Costs of Recommended Improvements

Since all of the headworks facilities are new and their recommended improvements are not large in scope, estimated costs for the necessary repairs at the headworks facilities have not been determined as it is felt that detailed in-depth engineering analyses are required before any specific recommendations and estimates can be made. Many of the minor repairs required by the existing equipment can in all probability be rectified by expansion of the maintenance budget. Specific work item costs can only be identified by a detailed engineering analysis.

APPENDIX A

INTERCEPTOR DATA

APPENDIX A

INTERCEPTOR DATA

In connection with the analysis of the MDC interceptor system for adequacy, the physical properties of each section of the interceptor system were collected from MDC files and construction drawings. Any modifications to the interceptor system that were made after they were originally built were also obtained. Table A-1 lists all pertinent interceptor data for the North Metropolitan Sewerage System tributary to the Deer Island Treatment Plant. Table A-2 lists all pertinent interceptor data for the South Metropolitan Sewerage System contributing flow to the Nut Island Treatment Plant. Table A-3 explains the abbreviations used in Tables A-1 and A-2 relating to community and interceptor names.

Tables A-1 and A-2 are arranged in accordance with MDC sewer section numbers for easy reference and retrieval of any additional data from MDC files which are arranged on a similar basis. These tables show for each sewer segment the MDC section number; the community in which it is located; its stations and inverts; its size, shape, length, slope and area; and its selected Manning's friction factor along with its capacity both in cubic feet per second and million gallons per day.

For the location of each of those sewers and their names, see Figure 2-2.

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
2	DI	19+30.00	92.36	24+30.00	92.56	108	CIRCULAR	500.00	0.000400	63.62	.016	203.40	131.45
3	DI	0+00.00	92.56	3+61.00	92.67	108	CIRCULAR	361.00	0.000304	63.62	.016	177.30	114.59
3	DI	3+61.00	92.67	7+85.00	92.81	108X111	EXT. CIRCLE	424.00	0.000330	65.87	.016	193.60	125.12
3	DI	7+85.00	92.81	10+70.00	92.90	108	CIRCULAR	285.00	0.000315	63.62	.016	179.90	115.27
3	DI	10+70.00	92.90	26+33.00	93.57	108X111	EXT. CIRCLE	1563.00	0.000428	65.87	.016	220.50	142.50
3.5	DI WTP	0+85.25	93.57	4+30.00	94.84	73.50	SIPHON	344.75	0.003683	29.45	.016	155.50	100.50
4	WTP	0+00.00	94.84	10+26.00	95.16	108	CIRCULAR	1026.00	0.000311	63.62	.016	179.90	115.27
4	WTP	10+26.00	95.16	11+17.00	95.18	107X110	OVAL	91.00	0.000219	64.90	.016	154.50	99.85
4	WTP	11+17.00	95.18	12+11.00	95.22	107X112	OVAL	94.00	0.000425	66.04	.016	220.30	142.38
4	WTP	12+11.00	95.22	13+32.00	95.26	107X110	OVAL	121.00	0.000165	64.90	.016	134.10	85.67
4	WTP	13+32.00	95.26	13+55.00	95.26	107X112	OVAL	21.00		66.04	.016		
4	WTP	13+55.00	95.26	21+73.00	95.52	107X110	OVAL	818.00	0.000317	64.90	.016	184.20	119.04
4	WTP	21+73.00	95.52	41+21.00	96.13	107X112	OVAL	1948.00	0.000313	66.04	.016	189.60	122.53
4	WTP	41+21.00	96.13	57+11.00	96.62	107X110	OVAL	1590.00	0.000303	64.90	.016	181.20	117.11
5	WTP	0+00.00	96.62	1+48.00	96.67	108X110	OVAL	148.00	0.000337	65.12	.016	192.80	124.60
5	WTP	1+48.00	96.67	8+67.00	96.89	108	CIRCULAR	719.00	0.000305	63.62	.016	177.60	114.78
5	WTP	8+67.00	96.89	10+77.00	96.96	108X110	OVAL	210.00	0.000333	65.12	.016	191.60	123.83
5	WTP	10+77.00	96.96	14+82.00	97.08	108X112	OVAL	405.00	0.000296	66.62	.016	108.00	69.80
5	WTP	14+82.00	97.08	14+90.00	97.09		TRANSITION	8.00	0.001250				
5	WTP	14+90.00	97.09	17+54.00	97.17	102X110.50	HORSESHOE	264.00	0.000303	66.20	.016	186.60	120.60
5	WTP	17+54.00	97.17	24+25.00	97.38	102X112	HORSESHOE	671.00	0.000312	67.29	.016	194.10	125.44
5	WTP	24+25.00	97.38	24+45.00	97.39		TRANSITION	20.00	0.000500				

TABLE A-1 MCC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	CAPACITY (MGD)
5	WTP	24+45.00	97.39	25+35.00	97.41	108X110.5	OVAL	90.00	0.000222	65.51	.016	159.70	103.21
5	WTP	25+35.00	97.41	26+39.00	97.45	108X112	OVAL	104.00	0.000384	66.62	.016	211.90	135.95
5	WTP	26+39.00	97.45	26+44.00	97.45		TRANSITION	5.00					
5	WTP	26+44.00	97.45	41+15.00	97.91	102X110.5	HORSESHOE	1471.00	0.000312	66.20	.016	189.60	122.53
5	WTP	41+15.00	97.91	42+32.00	97.94	102X108	OVAL	117.00	0.000256	64.42	.016	165.60	107.02
5	WTP	42+32.00	97.94	42+50.00	97.95	108	CIRCULAR	18.00	0.000555	63.62	.016	240.30	155.30
5	WTP	42+50.00	97.95	46+00.00	98.06	108	CIRCULAR	350.00	0.000314	63.62	.016	179.90	115.27
6	WTP	0+00.00	98.06	4+75.00	98.21	108	CIRCULAR	475.00	0.000315	63.62	.016	179.90	116.27
6	WTP	4+75.00	98.21	20+13.00	98.69	108X110.5	EXT. CIRCLE	1538.00	0.000312	65.51	.016	185.90	120.79
6	WTP	20+13.00	98.69	20+33.00	98.70		TRANSITION	20.00	0.000500				
6	WTP	20+33.00	98.70	41+12.00	99.35	102X110.5	HORSESHOE	2079.00	0.000312	66.20	.016	189.60	122.53
7	WTP EP	0+00.00	99.33	3+70.00	99.44	102X110.5	HORSESHOE	370.00	0.000297	66.20	.016	184.70	119.37
7	WTP EP	3+70.00	99.44	5+90.00	100.87	3-57	SIPHON	20.00	0.071500	53.13	.016	304.90	197.05
7	WTP EP	5+90.00	100.87	6+90.00	100.87		SANDCATCHER	100.00					
7	WTP EP	6+90.00	100.87	8+48.00	100.89	102X110.5	HORSESHOE	158.00	0.000126	66.20	.016	120.30	77.75
8	EP	0+00.00	100.92	0+05.00	101.02		DROP MANHOLE	5.00	0.020000				
8	EP	0+05.00	100.92	3+13.00	101.02	102X110.50	HORSESHOE	313.00	0.000319	66.20	.016	191.40	123.70
8	EP	3+13.00	101.02	3+49.00	101.03		TRANSITION	36.00	0.000277				
8	EP	3+49.00	101.03	33+47.00	102.03	108X110.50	EXT. CIRCLE	2998.00	0.000333	65.12	.016	191.60	123.83
8	EP	33+47.00	102.03	33+57.00	102.04		TRANSITION	10.00	0.001000				
8	EP	33+57.00	102.04	34+08.00	102.06	120X96	HORSESHOE	51.00	0.000392	63.36	.016	200.10	129.32
8	EP	34+08.00	102.06	36+68.00	102.14	108X110.50	EXT. CIRCLE	260.00	0.000307	65.12	.016	184.00	118.92

TABLE A-1 MCC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
8	EB	36+68.00	102.14	37+00.00	102.15	120X96	HORSESHOE	32.00	0.000312	63.36	.016	178.50	115.36
8	EB	37+00.00	102.15	37+20.00	102.16		TRANSITION	20.00	0.000500				
8	EB	37+20.00	102.16	41+30.00	102.30	102X110.5	HORSESHOE	410.00	0.000341	66.20	.016	197.90	127.90
9	EB	0+00.00	102.27	13+55.00	102.72	102X110.5	HORSESHOE	1355.00	0.000332	66.20	.016	195.60	126.41
9	EB	13+55.00	102.72	13+75.00	102.73		TRANSITION	20.00	0.000500				
9	EB	13+75.00	102.73	33+82.00	103.40	108X110.50	EXT. CIRCLE	2007.00	0.000333	65.49	.016	192.80	124.60
11	CHL	0+00.00	96.72	30+39.00	100.52	25X36	CATENARY	3039.00	0.001250	4.83	.016	11.50	7.43
12	CHL	0+00.00	88.64	30+33.70	90.06	100X110.50	BASKT HANDLE	3033.70	0.000468	64.80	.016	225.20	145.54
14	CHL	0+00.00	90.06	5+48.00	90.24	100X110.50	BASKT HANDLE	548.00	0.000328	64.80	.016	190.00	122.79
14	CHL	5+48.00	90.24	9+19.00	90.57	106	CIRCULAR	371.00	0.000350	61.24	.016	180.80	116.85
14	CHL	9+19.00	90.37	12+19.00	90.47	106X106.50	OVAL	300.00	0.000333	61.58	.016	177.40	114.65
14	CHL	12+19.00	90.47	16+71.00	90.62	106	CIRCULAR	452.00	0.000331	61.24	.016	175.30	113.94
14	CHL	16+71.00	90.62	16+90.00	90.62		TRANSITION	19.00					
14	CHL	16+90.00	90.62	17+48.00	90.64	106X110.50	OVAL	58.00	0.000344	67.58	.016	204.50	132.23
14	CHL	17+48.00	90.64	17+61.00	90.65	106X112.50	OVAL	13.00	0.000769	69.08	.016	314.90	203.51
14	CHL	17+61.00	90.65	18+18.00	90.67	106X110.50	OVAL	57.00	0.000350	67.58	.016	206.40	133.39
14	CHL	18+18.00	90.67	20+02.00	90.73	106X110.50	OVAL	184.00	0.000271	67.58	.016	181.60	117.36
14	CHL	20+02.00	90.73	21+24.00	90.77	106	CIRCULAR	122.00	0.000327	61.24	.016	175.30	113.94
14	CHL	21+24.00	90.77	25+05.00	90.89	100X114	BASKT HANDLE	381.00	0.000314	67.23	.016	193.80	125.25
14	CHL	25+05.00	90.89	32+09.00	91.13	100X108.50	BASKT HANDLE	704.00	0.000340	63.41	.016	184.40	119.17
14	CHL	32+09.00	91.13	33+02.00	91.16	100X110.50	BASKT HANDLE	93.00	0.000322	64.80	.016	186.80	120.72
14	CHL	33+02.00	91.16	33+32.00	91.17	100X108.50	BASKT HANDLE	30.00	0.000333	63.41	.016	184.40	119.17

TABLE A-1 MCC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
14	CHL	33+32.00	91.16	33+42.00	91.30		TRANSITION	10.00	0.014000				
14	CHL	33+42.00	91.30	34+44.58	91.34	98X106	BASKT HANDLE	102.58	0.000389	60.37	.016	187.20	120.98
15	CHL	0+00.00	91.34	17+54.00	91.92	98X106.50	BASKT HANDLE	1754.00	0.000330	60.71	.016	174.20	112.58
16	EVF	0+00.00	91.92	21+06.00	92.62	98X106.50	BASKT HANDLE	2106.00	0.000332	60.71	.016	174.20	112.58
16	EVF	21+06.00	92.62	21+70.00	92.64	98X108.50	BASKT HANDLE	64.00	0.000312	62.08	.016	176.40	114.00
16	EVF	21+70.00	92.64	32+00.00	92.99	98X106.50	BASKT HANDLE	1030.00	0.000339	60.71	.016	174.20	112.58
16	EVF	32+00.00	92.99	32+90.00	93.02	98X108.50	BASKT HANDLE	90.00	0.000333	62.08	.016	182.30	117.82
16	EVF	32+90.00	93.02	35+72.16	93.11	98X106.50	BASKT HANDLE	282.16	0.000318	60.71	.016	170.20	110.00
16	EVF	35+72.16	93.11	35+88.25	93.12		BELLMOUTH	16.09	0.000621				
16	EVF	35+88.25	93.12	44+30.66	94.17	70X76.50	BASKT HANDLE	842.41	0.001246	31.14	.016	133.60	89.57
17	EVF	0+00.00	94.17	32+92.00	95.28	70X76	BASKT HANDLE	3292.00	0.000337	31.10	.016	71.60	46.27
17	EVF	32+92.00	95.28	33+05.00	96.02		BELLMOUTH	13.00	0.056923				
17	EVF	33+05.00	96.02	35+27.50	96.17	56X61.50	BASKT HANDLE	222.50	0.000674	19.94	.016	56.20	36.32
17.5	EVF	0+00.00	96.17	16+27.00	97.34	56X61.50	BASKT HANDLE	1627.00	0.000719	19.80	.016	57.80	37.35
19	EVF MFD	0+00.00	97.34	4+21.00	98.00	48	SIPHON	421.00	0.156769	12.57	.016	43.47	28.09
20	MFD	0+00.00	98.20	5+68.00	98.63	55X61	BASKT HANDLE	568.00	0.000757	19.75	.016	58.66	37.91
20	MFD	5+68.00	98.63	7+03.00	98.70	60	CIRCULAR	135.00	0.000518	19.64	.016	48.20	31.15
20	MFD	7+03.00	98.70	13+90.00	99.20	55X61	BASKT HANDLE	687.00	0.000727	19.75	.016	57.40	37.10
20	MFD	13+90.00	99.20	76+11.00	103.20	53X56	BASKT HANDLE	6221.00	0.000642	17.14	.016	44.80	28.95
20BP	MFD	0+00.00	98.69	15+30.00	101.25	24	CIRCULAR	1530.00	0.001673	3.14	.016	7.52	4.86
21	MFD	0+00.00	103.20	19+65.00	104.40	53X56	BASKT HANDLE	1865.00	0.000643	17.14	.016	44.80	28.95
21	MFD	18+65.00	104.40	25+95.00	104.77	53X56	BASKT HANDLE	730.00	0.000506	17.14	.016	39.50	25.53

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
21	MFD	25+95.00	104.77	82+70.00	107.60	51X54	BASKT HANDLE	5675.00	0.000498	15.88	.016	35.80	23.14
22	MFD	0+00.00	107.60	17+90.00	108.91	40X42	BASKT HANDLE	1790.00	0.000731	10.26	.016	24.00	15.51
22	MFD	17+90.00	108.91	20+46.00	109.04	40X42	BASKT HANDLE	256.00	0.000507	10.26	.016	20.03	12.94
22	MFD	20+46.00	109.04	20+56.00	109.05		REDUCER	10.00	0.001000				
22	MFD	20+56.00	109.05	29+85.00	109.51	40X44	BASKT HANDLE	929.00	0.000495	10.82	.016	20.91	13.51
22	MFD	29+85.00	109.51	60+33.00	111.03	40X42	BASKT HANDLE	3048.00	0.000498	10.26	.016	19.80	12.80
23	EVE	0+00.00	94.05	22+67.73	95.18	72X80.50	BASKT HANDLE	2267.73	0.000498	33.60	.016	97.00	62.69
24	EVE CHA	0+00.00	95.18	23+32.00	96.35	72X80	BASKT HANDLE	2332.00	0.000501	33.50	.016	97.00	62.69
25	CHA	0+00.00	96.35	1+74.00	96.41	72X80	BASKT HANDLE	174.00	0.000344	33.35	.016	80.40	51.96
25	CHA	1+74.00	96.41	1+94.00	96.41		TRANSITION	20.00					
25	CHA	1+94.00	96.41	2+20.00	96.42		TRANSITION	26.00	0.000384				
25	CHA	2+20.00	96.42	3+35.00	96.42	72X85	BASKT HANDLE	115.00		35.85	.016		
25	CHA	3+35.00	96.42	3+96.58	96.51		PUMP STATION	61.58	0.001461				
25	CHA	3+96.58	96.51	15+36.40	88.49	60	SIPHON	1139.82	0.007036	19.64	.016	159.80	103.28
25.5	CHA	2+00.00	88.49	5+10.00	88.59	79.5X89.25	CATENARY	310.00	0.000322	38.81	.016	94.87	61.31
25.5	CHA	5+10.00	88.59	7+85.35	88.68	77X86	CATENARY	275.35	0.000326	36.10	.016	85.10	55.64
26	CHA	0+00.00	88.68	5+27.00	89.20	77X86	CATENARY	527.00	0.000986	36.10	.016	150.00	96.94
26	CHA	5+27.00	89.20	42+33.37	90.63	69X76	CATENARY	3706.37	0.000388	29.45	.016	71.30	46.08
27	SOM CAM	0+00.00	90.63	12+23.00	91.10	69X78	CATENARY	1223.00	0.000384	29.45	.016	71.20	46.02
27	SOM CAM	12+23.00	91.10	12+37.00	91.11		TRANSITION	14.00	0.000714				
27	SOM CAM	12+37.00	91.11	24+04.00	91.64	62X69	CATENARY	1167.00	0.000454	23.37	.016	62.30	40.26
27	SOM CAM	24+04.00	91.64	24+16.00	91.64		BELLMOUTH	12.00					

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
27	SOM CAM	24+16.00	91.64	47+77.00	93.04	62X69	CATENARY	2361.00	0.000592	23.37	.016	62.30	40.26
27	SOM CAM	47+77.00	93.04	47+93.00	92.72		REGULATOR	16.00					
28	CAM		93.04	0+00.00	94.21		DROP MANHOLE						
28	CAM	0+00.00	94.21	65+03.10	97.16	48X54	CATENARY	6503.10	0.000453	14.22	.016	29.30	18.94
29	CAM	13+50.00	97.77	17+35.00	97.95	54	CIRCULAR	385.00	0.000455	14.22	.016	34.10	22.04
29	CAM	17+35.00	97.95	17+44.00	98.10		TRANSITION	9.00	0.011111				
29	CAM	17+44.00	98.10	30+56.00	98.88	44X50	CATENARY	1312.00	0.000594	12.12	.016	27.00	17.45
29	CAM	30+56.00	98.88	30+66.00	98.96		TRANSITION	10.00	0.008000				
29	CAM	30+66.00	98.96	51+57.34	100.34	42X48	CATENARY	2091.34	0.000659	10.98	.016	25.20	16.29
30	CAM	0+00.00	100.36	21+79.90	101.82	41X46	CATENARY	2179.90	0.000669	10.57	.016	24.00	15.51
30	CAM	21+79.90	101.82	21+90.10	102.04		BELLMOUTH	10.10	0.021782				
30	CAM	21+90.10	102.04	26+18.28	102.49	34X36	BASKT HANDLE	428.18	0.001050	6.71	.016	16.30	10.53
30	CAM	26+18.28	102.49	32+73.28	102.81	36	CIRCULAR	655.00	0.000488	7.07	.016	12.00	7.76
30	CAM	32+73.28	102.81	34+27.28	102.97	34X36	BASKT HANDLE	154.00	0.000105	6.71	.016	16.30	10.53
30	CAM	34+27.28	102.97	34+59.28	103.04	34X42	BASKT HANDLE	32.00	0.002187	8.52	.016	32.40	20.94
30	CAM	34+59.28	103.04	37+48.28	103.22	24.30	CIRCULAR	289.00	0.000622	8.05	.016	15.00	10.34
30	CAM	37+48.28	103.22	40+94.88	103.43	34X42	BASKT HANDLE	345.60	0.000605	8.52	.016	17.00	10.99
30	CAM	40+94.88	103.43	54+86.28	104.28	32X34	BASKT HANDLE	1391.40	0.000610	6.16	.016	11.10	7.17
30	CAM	54+86.28	104.28	73+08.48	105.69	26.5X28	BASKT HANDLE	1822.20	0.000773	4.37	.016	7.90	5.11
31BR	CHA	0+00.00	92.00	6+59.50	102.25	15	CIRCULAR	659.50	0.015542	1.23	.016	6.54	4.23
31	CHA	0+00.00	90.14	0+42.00	90.76	34X36	BASKT HANDLE	42.00	0.014761	7.92	.016	77.07	49.81
31	CHA	0+42.00	90.76	0+65.00	90.76		REGULATOR	23.00					

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
31	CHA	0+65.00	90.76	3+95.00	94.85	29X37	GOTHIC	330.00	0.012393	5.48	.016	42.90	27.73
31	CHA	3+95.00	94.85	31+67.60	96.23	37X44	GOTHIC	2772.60	0.000497	8.97	.016	16.60	10.73
31	CHA	31+67.60	96.23	31+67.60	96.43		DROP MANHOLE						
31	CHA	31+67.60	96.43	38+49.30	96.91	31X39	GOTHIC	673.30	0.000712	6.51	.016	12.90	8.34
32	CHA	38+40.00	96.89	47+00.00	97.48	31X39	GOTHIC	860.00	0.000698	6.51	.016	12.80	8.27
32	CHA	47+00.00	97.48	63+16.00	98.78	29X37	GOTHIC	1616.00	0.000804	5.48	.016	10.90	7.04
32	CHA	63+16.00	98.78	63+16.00	98.85		DROP MANHOLE						
32	CHA	63+16.00	98.85	69+21.00	99.33	27X36	GOTHIC	605.00	0.000793	5.15	.016	10.01	6.47
32	CHA	69+21.00	99.33	69+21.00	99.40		DROP MANHOLE						
32	CHA	69+21.00	99.40	85+87.00	100.91	25X34	GOTHIC	1666.00	0.000906	4.49	.016	8.80	5.69
32	CHA	85+87.00	100.91	85+87.00	101.01		DROP MANHOLE						
32	CHA	85+87.00	101.01	91+57.00	101.57	22X31	GOTHIC	570.00	0.000982	3.55	.016	6.80	4.39
32	CHA	91+57.00	101.57	91+57.00	101.67		DROP MANHOLE						
32	CHA	91+57.00	101.67	101+16.60	102.71	19X28	GOTHIC	959.60	0.001083	2.74	.016	5.06	3.27
35	CHA MFD	0+00.00	91.20	9+20.00	91.51	40X49	GOTHIC	920.00	0.000336	10.84	.016	17.50	11.31
35	CHA MFD	9+20.00	91.51	9+20.00	91.58		DROP MANHOLE						
35	CHA MFD	9+20.00	91.58	33+79.00	92.40	39X47.50	GOTHIC	2459.00	0.000333	10.15	.016	15.90	10.28
35	CHA MFD	33+79.00	92.40	33+79.00	92.81		DROP MANHOLE						
35	CHA MFD	33+79.00	92.81	40+86.00	93.04	35X43.50	GOTHIC	707.00	0.000325	9.25	.016	13.90	8.98
35	CHA MFD	40+86.00	93.04	40+86.00	94.20		DROP MANHOLE						
35	CHA MFD	40+86.00	94.20	83+70.00	97.21	22X27.50	GOTHIC	4284.00	0.000702	3.08	.016	4.70	3.04
36	FB	0+00.00	93.20	0+18.00	100.93	15	CIRCULAR	18.00	0.429444	1.23	.015	34.37	22.21

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
36	FB	0+18.00	100.93	2+35.34	102.02	15	CIRCULAR	217.34	0.005015	1.23	.015	3.71	2.40
37	FB	0+00.00	89.27	4+55.00	89.64	40.50X45.50	CATENARY	455.00	0.006747	10.06	.016	71.46	46.18
37	FB	4+55.00	85.64	4+75.00	89.90		BELLMOUTH	20.00	0.013000				
37	FB	4+75.00	89.90	20+85.00	91.20	36.50X41	CATENARY	1610.00	0.000807	8.12	.016	18.55	11.99
37	FB	20+85.00	91.20	20+95.00	91.20		BELLMOUTH	10.00					
37	FB	20+95.00	91.20	48+81.78	93.45	36.50X41	CATENARY	2786.78	0.000803	8.12	.016	18.55	11.99
37.5	FB	0+00.00	85.27	0+45.00	89.22	40.50X45.50	CATENARY	45.00	0.001111	10.06	.016	29.00	18.74
37.5	FB	0+45.00	85.22	0+65.00	88.70		REGULATOR	20.00	0.026000				
37.5	FB	0+65.00	88.70	2+76.14	88.54	40.50X45.50	CATENARY	211.14	0.000757	10.06	.016	23.93	15.47
38	FB	0+00.00	93.45	9+03.00	94.18	36.50X41	CATENARY	903.00	0.000808	8.12	.016	18.55	11.99
38	FB	9+03.00	94.18	9+35.00	94.20	42	CIRCULAR	32.00	0.000625	9.62	.016	20.48	13.24
38	FB	9+35.00	94.20	10+25.00	94.27	36.50X41	CATENARY	90.00	0.000777	8.12	.016	18.55	11.99
38	FB	10+25.00	94.27	10+25.00	94.87		DROP MANHOLE						
38	FB	10+25.00	94.87	10+78.00	94.98	24	CIRCULAR	53.00	0.002075	3.14	.016	3.38	5.42
38	FB	10+78.00	94.98	12+00.00	95.22	18	CIRCULAR	122.00	0.001967	1.77	.016	3.79	2.45
38	FB	12+00.00	95.22	26+00.00	98.12	18	CIRCULAR	1400.00	0.002071	1.77	.016	3.89	2.51
38	FB	26+00.00	98.12	51+00.00	103.13	15	CIRCULAR	2500.00	0.002004	1.23	.016	2.35	1.52
38	FB	51+00.00	103.13	51+00.00	103.23		DROP MANHOLE						
38	FB	51+00.00	103.23	55+98.32	113.02	12	CIRCULAR	498.32	0.019646	.79	.016	4.06	2.62
38BP	FB	0+00.00	98.12	17+90.00	101.10	15	CIRCULAR	1790.00	0.001664	1.23	.016	2.14	1.38
38BP	FB	17+90.00	101.10	26+31.00	102.89	12	CIRCULAR	941.00	0.001902	.79	.016	1.26	.81
39	FB	0+00.00	94.34	2+91.00	95.07	18	CIRCULAR	291.00	0.002508	1.77	.016	4.27	2.76

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
39	EB	2+91.00	95.07	7+34.00	96.18	18	CIRCULAR	443.00	0.002505	1.77	.016	4.27	2.76
39	EB	7+34.00	96.18	17+49.00	99.36	18	CIRCULAR	1015.00	0.003133	1.77	.016	4.78	3.09
39	EB	17+49.00	99.36	26+91.00	104.12	15	CIRCULAR	942.00	0.005053	1.23	.016	3.78	2.44
39	EB	26+91.00	104.12	32+55.00	106.37	15	CIRCULAR	564.00	0.003989	1.23	.016	3.32	2.15
38	EB	32+55.00	106.37	49+70.18	113.33	12	CIRCULAR	1715.18	0.004057	.79	.016	1.84	1.19
39BR	EB	0+00.00	99.38	4+95.00	100.42	15	CIRCULAR	495.00	0.002101	1.23	.016	2.41	1.56
39BR	EB	4+95.00	100.42	19+75.80	104.17	12	CIRCULAR	1480.80	0.002532	.79	.016	1.45	.94
40	EVE MAL	0+00.00	96.21	62+35.00	98.70	45X49	BASKT HANDLE	6235.00	0.000399	12.91	.015	25.79	16.67
40	EVE MAL	62+35.00	98.70	62+45.00	99.57		BELLMOUTH	10.00	0.087000				
40	EVE MAL	62+45.00	99.57	62+51.74	99.57	24	CIRCULAR	6.74		3.14	.015		
41	MAL MEL	0+00.00	99.57	10+50.00	107.97	20X30	OVAL	1050.00	0.008000	3.26	.015	18.52	11.97
41	MAL MEL	10+50.00	107.97	11+80.00	113.10	20X30	OVAL	130.00	0.039461	3.26	.015	41.13	25.58
41	MAL MEL	11+80.00	113.10	23+70.00	125.00	20X30	OVAL	1190.00	0.010000	3.26	.015	20.70	13.38
41	MAL MEL	23+70.00	125.00	24+01.00	131.66	20X30	OVAL	31.00	0.214838	3.26	.015	95.99	62.04
41	MAL MEL	24+01.00	131.66	44+49.00	133.72	25X38	OVAL	2048.00	0.001005	5.14	.015	12.02	7.77
41	MAL MEL	44+49.00	133.72	74+65.00	136.74	22X33	OVAL	3016.00	0.001001	3.94	.015	8.40	5.43
41	MAL MEL	74+65.00	136.74	96+00.00	138.87	20X30	OVAL	2135.00	0.000997	3.26	.015	6.53	4.22
41	MAL MEL	96+00.00	138.87	108+06.63	140.00	20X30	OVAL	1206.64	0.000936	3.26	.015	6.33	4.09
42	MEL	0+00.00	140.45	30+49.95	147.00	12	CIRCULAR	3049.95	0.002147	.79	.015	1.43	.92
43	SOM CAM	0+00.00	97.75	27+55.00	99.69	35X42	GOTHIC	2755.00	0.000704	7.92	.016	16.83	10.88
43	SOM CAM	27+55.00	99.69	51+55.00	101.42	29X37	GOTHIC	2400.00	0.000720	5.48	.016	10.36	5.70
43	SOM CAM	51+55.00	101.42	68+20.00	102.62	27X35	GOTHIC	1665.00	0.000720	4.95	.016	9.05	5.85

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
43	SOM CAM	68+20.00	102.62	79+85.00	103.47	23X33	GOTHIC	1165.00	0.000729	4.00	.016	6.88	4.45
43	SOM CAM	79+85.00	103.47	79+85.00	103.81		DROP MANHOLE						
43	SOM CAM	79+85.00	103.81	107+70.00	106.13	18	CIRCULAR	2785.00	0.000833	1.77	.016	2.46	1.59
43	PRD DWY	0+00.00	100.35	0+56.00	100.75	15	CIRCULAR	56.00	0.007142	1.23	.016	4.45	2.88
43	HND RSN	0+00.00	101.24	0+87.00	101.98	10	CIRCULAR	87.00	0.008505	.55	.016	1.61	1.04
43.5	MFD SOM	0+21.71	108.27	8+05.00	108.79	36X43	GOTHIC	783.29	0.000667	8.47	.016	17.73	11.46
43.5	MFD SOM	8+05.00	108.72	8+10.00	95.80	24	SIPHON	5.00		3.14	.016	17.48	11.30
43.5	MFD SOM	8+10.00	96.60	9+00.00	95.80	24	SIPHON	90.00		3.14	.016	17.48	11.30
43.5	MFD SOM	9+00.00	95.80	9+10.00	110.32	24	SIPHON	10.00		3.14	.016	17.48	11.30
43.5	MFD SOM	9+10.00	110.32	22+26.00	111.17	36X43	GOTHIC	1316.00	0.000645	8.47	.016	17.79	11.50
43.5	MFD SOM	23+44.00	97.58	26+00.07	97.75	35X42	GOTHIC	256.07	0.000663	7.92	.016	16.38	10.59
44	WIN	0+00.00	114.04	30+79.00	115.88	31X35.25	GOTHIC	3079.00	0.000500	5.96	.016	7.67	4.96
44	WIN	30+79.00	115.58	30+79.00	115.71		DROP MANHOLE						
44	WIN	30+79.00	115.71	47+00.00	117.06	27X30.38	GOTHIC	1621.00	0.000832	4.51	.016	7.67	4.96
44	WIN	47+00.00	117.06	47+00.00	117.13		DROP MANHOLE						
44	WIN	47+00.00	117.13	56+07.53	117.88	24X29.50	GOTHIC	907.53	0.000826	3.89	.016	8.70	5.62
44.5	MFD WIN	0+00.00	111.03	32+97.50	112.49	35X39	GOTHIC	3297.50	0.000442	7.36	.016	12.06	7.79
44.5	MFD WIN	32+97.50	112.49	53+11.00	113.38	33X37	GOTHIC	2013.50	0.000442	6.62	.016	10.42	5.73
44.5	MFD WIN	53+11.00	113.38	53+52.00	113.83	20	SIPHON	41.00	0.010976	2.18	.016	7.49	4.84
44.5	MFD WIN	53+52.00	113.83	56+84.00	113.97	33X37	GOTHIC	332.00	0.000421	6.62	.016	10.17	6.57
45	WIN	0+00.00	117.88	20+39.00	119.58	24X29.50	GOTHIC	2039.00	0.000833	3.89	.016	6.93	4.48
45	WIN	20+39.00	119.58	20+42.00	119.59	24	CIRCULAR	3.00	0.003333	3.14	.016	11.34	7.33

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
45	WIN	20+42.00	119.59	25+62.00	119.85	24X29.50	GOTHIC	520.00	0.000500	3.89	.016	5.50	3.55
45	WIN	25+62.00	119.85	25+67.00	119.86	24	CIRCULAR	5.00	0.002000	3.14	.016	8.23	5.32
45	WIN	25+67.00	119.86	43+41.00	121.50	24X29.50	GOTHIC	1774.00	0.000924	3.89	.016	7.48	4.83
45	WIN	43+41.00	121.50	43+66.00	121.52	24	CIRCULAR	25.00	0.000800	3.14	.016	5.55	3.59
45	WIN	43+66.00	121.52	45+40.00	121.67	24X29.50	GOTHIC	174.00	0.000862	3.89	.016	7.22	4.67
45	WIN	45+40.00	121.67	54+36.00	122.42	22X27.50	GOTHIC	896.00	0.000837	3.26	.016	5.61	3.63
45	WIN	54+36.00	122.42	54+80.00	122.45	24	CIRCULAR	44.00	0.000681	3.14	.016	5.12	3.31
45	WIN	54+80.00	122.45	56+55.00	122.73	22X27.50	GOTHIC	175.00	0.025714	3.26	.016	31.10	20.10
45	WIN	56+55.00	122.73	56+55.00	127.23		DROP MANHOLE						
45	WIN	56+55.00	127.23	65+07.00	128.08	22X27.50	GOTHIC	852.00	0.001009	3.26	.016	6.13	3.96
46	WIN WOB	0+00.00	128.06	23+75.00	130.45	22X28	GOTHIC	2375.00	0.001006	3.33	.016	5.30	4.07
46	WIN WOB	23+75.00	130.45	25+43.00	130.62	18X24.50	GOTHIC	168.00	0.001011	2.38	.016	4.03	2.60
46	WIN WOB	25+43.00	130.62	25+71.00	130.65	20	CIRCULAR	28.00	0.001071	2.18	.016	3.97	2.57
46	WIN WOB	25+71.00	130.65	34+56.00	133.39	18X24.50	GOTHIC	885.00	0.003096	2.38	.016	7.06	4.56
46	WIN WOB	34+55.00	133.39	34+56.00	133.70		DROP MANHOLE						
46	WIN WOB	34+56.00	133.70	57+50.00	147.50	15	CIRCULAR	2294.00	0.006015	1.23	.016	4.34	2.80
47	WIN WOB	0+00.00	122.75	1+35.00	122.89	20	CIRCULAR	135.00	0.001037	2.18	.016	3.66	2.37
47	WIN WOB	1+35.00	122.89	1+87.00	122.94	15	SIPHON	52.00	0.000961	2.18	.016	1.22	0.79
47	WIN WOB	1+87.00	122.94	10+87.00	124.29	20	CIRCULAR	900.00	0.000133	2.18	.016	1.31	.85
47	WIN WOB	10+87.00	124.29	10+87.00	124.41		DROP MANHOLE						
47	WIN WOB	10+87.00	124.41	30+20.00	132.13	15	CIRCULAR	1933.00	0.003993	1.23	.016	3.32	2.15
47	WIN WOB	30+20.00	132.13	45+08.00	133.98	18	CIRCULAR	1488.00	0.001243	1.77	.016	3.01	1.95

TABLE A-1 MCC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	CAPACITY (MGD)
48	ARL SOM	0+00.00	98.60	0+00.00	99.00		DROP MANHOLE						
48	ARL SOM	0+00.00	99.00	5+55.80	100.39	12	CIRCULAR	555.80	0.002500	.79	.015	1.54	1.00
48	ARL SOM	0+00.00	99.00	4+54.45	100.20	18	CIRCULAR	454.45	0.002640	1.77	.015	4.68	3.02
48	ARL SOM	0+00.00	111.52	5+79.58	120.14	10	CIRCULAR	579.58	0.014872	.55	.015	2.29	1.48
48A	SOM	0+00.00	112.60	5+59.40	119.64	15	CIRCULAR	559.40	0.012584	1.23	.015	6.28	4.06
49	MFL	0+00.00	140.67	0+29.00	140.75	20	CIRCULAR	29.00	0.002758	2.18	.015	6.37	4.12
49	MFL	0+29.00	140.75	8+40.61	142.44	24	CIRCULAR	811.60	0.002082	3.14	.015	8.96	5.79
49	MFL	8+40.61	142.44	35+44.88	146.87	18	CIRCULAR	2704.28	0.001638	1.77	.015	3.69	2.38
49	MFL	35+44.88	146.87	38+88.04	147.42	15	CIRCULAR	341.16	0.001612	1.23	.015	2.25	1.45
50	MFL	0+00.00	147.43	2+50.00	147.76	18	CIRCULAR	250.00	0.001320	1.77	.015	3.31	2.14
50	MFL	2+50.00	147.76	10+01.50	148.73	18X20	GOTHIC	751.50	0.001290	2.82	.015	3.76	2.43
50	MFL	10+01.50	148.73	15+79.85	150.47	18X20	GOTHIC	578.35	0.003008	2.82	.015	5.74	3.71
50	MFL	15+79.85	150.47	15+79.85	151.67		DROP MANHOLE						
50	MFL	15+79.85	151.67	23+53.95	155.54	15	CIRCULAR	774.10	0.004999	1.23	.015	3.96	2.55
50	MFL	23+53.95	155.54	23+53.95	156.88		DROP MANHOLE						
50	MFL	23+53.95	156.88	26+49.85	159.13	15	CIRCULAR	295.90	0.007603	1.23	.015	4.89	3.16
50	MFL	26+49.85	159.13	26+49.85	159.47		DROP MANHOLE						
50	MFL	26+49.85	159.47	33+78.48	167.00	15	CIRCULAR	728.63	0.010334	1.23	.015	5.70	3.68
50	MFL	33+78.48	167.00	35+85.00	167.82	15	CIRCULAR	206.52	0.003970	1.23	.015	3.53	2.28
50	MFL	35+85.00	167.82	43+20.00	170.24	12	CIRCULAR	735.00	0.003292	.79	.015	1.77	1.14
50	MFL	43+20.00	170.24	46+64.55	171.02	12	CIRCULAR	344.55	0.002263	.79	.015	1.47	.95
51	MFL	0+00.00	150.47	5+05.00	153.94	12	CIRCULAR	505.00	0.006871	.79	.015	2.56	1.65

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
51	MEL	5+05.00	153.94	9+66.93	157.19	12	CIRCULAR	461.93	0.007035	.79	.015	2.59	1.67
51	MEL	9+66.93	157.19	12+88.95	164.06	12	CIRCULAR	322.02	0.021334	.79	.015	4.51	2.91
51	MEL	12+88.95	164.06	14+12.02	166.40	12	CIRCULAR	123.07	0.019013	.79	.015	4.26	2.75
51	MEL	14+12.02	166.40	21+19.81	173.97	12	CIRCULAR	705.79	0.014907	.79	.015	3.77	2.44
51	MEL	21+19.81	173.97	25+46.21	185.05	12	CIRCULAR	426.40	0.025984	.79	.015	4.98	3.22
51	MEL	25+46.21	185.05	27+54.69	188.84	12	CIRCULAR	208.48	0.018179	.79	.015	4.17	2.69
51	MEL	27+54.69	188.84	27+54.69	192.03		DROP MANHOLE						
51	MEL	27+54.69	192.03	28+60.95	194.96	12	CIRCULAR	106.26	0.027573	.79	.015	5.13	3.32
51	MEL	28+60.95	194.96	30+73.65	198.30	12	CIRCULAR	212.70	0.015702	.79	.015	3.87	2.50
51	MEL	30+73.65	198.30	30+73.65	203.20		DROP MANHOLE						
51	MEL	30+73.65	203.20	31+47.80	206.09	12	CIRCULAR	74.15	0.038975	.79	.015	6.10	3.94
51	MEL	31+47.80	206.09	34+54.86	217.84	10	CIRCULAR	307.06	0.038266	.55	.015	3.68	2.38
51	MEL	34+54.86	217.84	34+54.86	224.07		DROP MANHOLE						
51	MEL	34+54.86	224.07	36+20.59	235.99	10	CIRCULAR	165.73	0.071924	.55	.015	5.04	3.26
51	MEL	36+20.59	235.99	37+47.59	242.92	10	CIRCULAR	127.00	0.054566	.55	.015	4.39	2.84
51	MEL	37+47.59	242.92	38+72.79	245.44	10	CIRCULAR	125.20	0.020127	.55	.015	2.66	1.72
51	MEL	38+72.79	245.44	41+23.59	247.47	10	CIRCULAR	250.80	0.008094	.55	.015	1.69	1.09
52	ARL	0+00.00	100.20	11+44.10	102.14	18	CIRCULAR	1144.10	0.001695	1.77	.015	3.75	2.42
52	ARL	11+44.10	102.14	16+52.10	103.33	18	CIRCULAR	508.00	0.002342	1.77	.015	4.41	2.85
52	ARL	16+52.10	103.33	52+75.40	110.75	18	CIRCULAR	3623.30	0.002047	1.77	.015	4.12	2.66
52	ARL	52+75.40	110.75	52+75.40	110.90		DROP MANHOLE						
52	ARL	52+75.40	110.90	58+80.50	112.11	15	CIRCULAR	605.10	0.001999	1.23	.015	2.50	1.62

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
52	ARL	58+80.50	112.11	58+80.50	115.70		DROP MANHOLE						
52	ARL	58+80.50	115.70	60+88.00	121.09	12	CIRCULAR	207.50	0.025975	.79	.015	4.98	3.22
52	ARL	60+88.00	121.09	64+51.90	137.18	12	CIRCULAR	363.90	0.016735	.79	.015	4.00	2.59
52	ARL	64+51.90	137.18	73+57.07	152.57	12	CIRCULAR	905.17	0.017022	.79	.015	4.03	2.60
52	ARL	73+57.07	152.57	86+96.51	168.64	12	CIRCULAR	1339.44	0.012012	.79	.015	3.38	2.18
52	ARL	86+96.51	168.64	105+81.28	183.34	12	CIRCULAR	1884.79	0.007799	.79	.015	2.73	1.76
52	ARL	105+81.28	183.34	118+10.71	194.81	12	CIRCULAR	1229.43	0.009329	.79	.015	2.98	1.93
52	ARL	118+10.71	194.81	132+49.11	211.35	12	CIRCULAR	1438.40	0.011498	.79	.015	3.31	2.14
52	ARL	132+49.11	211.35	138+92.02	225.25	12	CIRCULAR	642.91	0.021620	.79	.015	4.54	2.93
53	ARL	0+00.00	225.25	6+51.20	228.90	18	CIRCULAR	651.20	0.005605	1.77	.015	6.82	4.41
53	ARL	6+51.20	228.90	6+51.20	231.09		DROP MANHOLE						
53	ARL	6+51.20	231.09	8+33.20	232.92	15	CIRCULAR	182.00	0.010054	1.23	.015	5.61	3.63
53	ARL	8+33.20	232.92	9+98.90	234.53	15	CIRCULAR	165.70	0.009716	1.23	.015	5.51	3.56
53	ARL	9+98.90	234.53	16+48.10	241.01	15	CIRCULAR	649.20	0.008441	1.23	.015	5.14	3.32
53	ARL	16+48.10	241.01	18+59.40	246.54	15	CIRCULAR	211.30	0.026171	1.23	.015	9.04	5.84
53	ARL	18+59.40	246.54	19+98.75	247.29	15	CIRCULAR	139.35	0.006099	1.23	.015	4.37	2.82
53	ARL	19+98.75	247.29	24+35.20	249.45	15	CIRCULAR	436.45	0.004949	1.23	.015	3.93	2.54
53	ARL	24+35.20	249.45	24+35.20	252.51		DROP MANHOLE						
53	ARL	24+35.20	252.51	32+23.50	256.84	15	CIRCULAR	788.30	0.005492	1.23	.015	4.14	2.68
53	ARL	32+23.50	256.84	33+78.30	259.61	15	CIRCULAR	154.80	0.017894	1.23	.015	7.48	4.83
53	ARL	33+78.30	259.61	45+10.58	264.73	15	CIRCULAR	1132.28	0.004521	1.23	.015	3.76	2.43
54	MAL	0+00.00	99.06	31+75.17	100.65	36	CIRCULAR	3175.17	0.000501	7.07	.016	12.10	7.82

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
54	MAL	31+75.17	100.65	31+75.17	100.90		DROP MANHOLE						
54	MAL	31+75.17	100.90	41+33.00	101.54	30	CIRCULAR	957.83	0.000668	4.91	.016	8.63	5.58
54	MAL	41+33.00	101.54	41+33.00	105.45		DROP MANHOLE						
54	MAL	41+33.00	105.45	52+19.00	107.01	18	CIRCULAR	1086.00	0.001436	1.77	.016	3.24	2.09
55	MAL	0+00.00	107.45	15+48.00	110.60	15	CIRCULAR	1548.00	0.002034	1.23	.016	2.37	1.53
56	CHL	0+00.00	100.55	26+40.00	101.87	42	CIRCULAR	2640.00	0.000500	9.62	.016	18.31	11.83
56	CHL	26+40.00	101.87	28+87.11	102.08	33	CIRCULAR	247.11	0.000849	5.94	.016	12.54	8.10
57	CHL	0+00.00	102.08	16+30.00	103.44	33	CIRCULAR	1630.00	0.000834	5.94	.016	12.42	8.03
57	CHL	16+30.00	103.44	22+70.00	103.97	30	CIRCULAR	640.00	0.000828	4.91	.016	9.63	6.22
57	CHL	22+70.00	103.97	22+70.00	104.22		DROP MANHOLE						
57	CHL	22+70.00	104.22	34+04.06	105.34	22X28	CATENARY	1134.06	0.000987	3.21	.016	5.94	3.84
57	CHL	34+04.06	105.34	54+26.00	123.41	22X28	CATENARY	2021.94	0.008936	3.21	.016	17.86	11.54
57A	REV CHL	0+00.00	105.10	10+31.05	107.16	15	CIRCULAR	1031.05	0.001997	1.23	.016	2.35	1.52
58	MAL MEL	0+00.00	125.00	26+88.00	136.57	48	CIRCULAR	2688.00	0.004304	12.57	.015	81.85	52.90
58	MAL MEL	26+88.00	136.57	46+03.00	137.33	54X58	EXT. CIRCLE	1915.00	0.000396	17.40	.015	38.58	24.93
58	MAL MEL	46+03.00	137.33	46+28.00	137.54	42	CIRCULAR	25.00	0.008400	9.62	.015	80.08	51.75
58	MAL MEL	46+28.00	137.54	53+93.56	137.85	54X58	EXT. CIRCLE	765.56	0.000404	17.40	.015	38.58	24.93
59	MEL	0+00.00	137.85	31+97.00	139.13	54X58	EXT. CIRCLE	3197.00	0.000400	17.40	.015	38.58	24.93
59	MEL	31+97.00	139.13	32+12.00	141.35		REDUCER	15.00	0.148000				
59	MEL	32+12.00	141.35	49+78.05	143.21	36	CIRCULAR	1766.05	0.001053	7.07	.015	18.79	12.14
60	MEL	0+00.00	143.21	27+76.00	146.13	36	CIRCULAR	2776.00	0.001051	7.07	.015	18.70	12.09
60	MEL	27+76.00	146.13	27+76.00	148.09		DROP MANHOLE						

TABLE A-1 MCC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
50	MFL	27+76.00	148.09	35+35.90	154.14	30	CIRCULAR	759.90	0.007961	4.91	.015	31.78	20.54
50	MFL	35+35.90	154.14	37+51.30	161.21	30	CIRCULAR	215.40	0.032822	4.91	.015	64.53	41.70
50	MFL	37+51.30	161.21	56+95.01	170.91	30	CIRCULAR	1943.71	0.004990	4.91	.015	25.16	16.26
51	CHL	0+00.00	91.10	31+37.00	92.48	54	CIRCULAR	3137.00	0.000439	15.90	.016	33.55	21.68
51	CHL	31+37.00	92.48	41+36.59	93.00	48	CIRCULAR	999.59	0.000520	12.57	.016	26.67	17.24
52	CHL	0+00.00	93.00	27+88.18	94.12	48	CIRCULAR	2788.18	0.000401	12.57	.016	23.39	15.12
52	MIL CR	0+03.17	94.12	2+41.00	94.23	2-36	SIPHON	237.83	0.000462	14.14	.016	18.60	12.02
52	MIL CR	2+41.00	94.23	3+90.00	94.28	48	CIRCULAR	149.00	0.000335	12.57	.016	21.40	13.83
53	CAM	0+00.00	110.00	47+83.90	114.78	24X28	EXT. CIRCLE	4783.90	0.000999	3.81	.016	7.50	4.85
53	CAM	47+83.90	114.78	50+20.00	119.58	22X28	EXT. CIRCLE	236.10	0.020330	3.21	.016	26.96	17.42
53	CAM	50+20.00	119.58	51+85.00	119.75	22X28	EXT. CIRCLE	165.00	0.001030	3.21	.016	6.06	3.92
53	CAM	51+85.00	119.75	57+30.00	120.29	25	CIRCULAR	545.00	0.000990	3.41	.016	6.43	4.16
53	CAM	57+30.00	120.29	58+09.00	120.37	22X28	CATENARY	79.00	0.001012	3.21	.016	6.01	3.88
53	CAM	58+09.00	120.37	63+58.45	123.15	22X28	CATENARY	549.45	0.005059	3.21	.016	13.45	8.69
54	MAL	0+00.00	98.42	13+10.00	100.00	54	CIRCULAR	1310.00	0.001206	15.90	.015	59.31	38.33
54	MAL	13+10.00	100.00	13+75.00	100.40	4-42	CIRCULAR	65.00	0.006153	38.48	.015	274.10	177.14
54	MAL	13+75.00	100.40	13+75.00	101.40		DROP MANHOLE						
54	MAL	13+75.00	101.40	15+46.00	102.35	42	CIRCULAR	171.00	0.005555	9.62	.015	65.10	42.07
54	MAL	15+46.00	102.35	17+38.00	106.15	28X42	OVAL	192.00	0.019791	6.33	.015	70.40	45.50
54	MAL	17+38.00	106.15	18+43.00	109.81	28X42	OVAL	105.00	0.034857	6.33	.015	93.44	60.39
54	MAL	18+43.00	109.81	20+15.00	117.41	28X42	OVAL	172.00	0.044186	6.33	.015	105.20	67.99
54	MAL	20+15.00	117.41	20+66.70	120.00	28X42	OVAL	51.70	0.050096	6.33	.015	112.00	72.38

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
4	MAL	20+66.70	120.00	23+73.00	130.80	28X42	OVAL	306.30	0.035259	6.33	.015	93.97	60.73
4	MAL	23+73.00	130.80	29+46.00	133.82	42	CIRCULAR	576.00	0.005243	9.62	.015	63.27	40.89
4	MAL	29+46.00	133.82	29+54.30	133.82		REDUCER	8.30					
5	MAL	41+31.39	101.54	71+97.03	103.58	30	CIRCULAR	3065.64	0.000665	4.91	.015	9.18	5.93
5	MAL	71+97.03	103.58	71+97.03	103.83		DROP MANHOLE						
5	MAL	71+97.03	103.83	86+30.16	105.25	24	CIRCULAR	1433.13	0.000990	3.14	.015	6.18	3.99
6	MAL	0+00.00	105.21	25+17.00	107.05	18	CIRCULAR	2517.00	0.000731	1.77	.015	2.47	1.60
6	MAL	25+17.00	107.05	25+17.00	119.58		DROP MANHOLE						
6	MAL	25+17.00	119.58	26+29.42	124.06	12	CIRCULAR	112.42	0.039850	.79	.015	6.17	3.99
7	MFD WIN	0+00.00	110.85	0+35.00	110.86	42	CIRCULAR	35.00	0.000285	9.62	.015	14.75	9.53
7	MFD WIN	0+35.00	110.86	48+00.00	112.77	54	CIRCULAR	4765.00	0.000400	15.90	.015	34.16	22.08
8	WIN	0+00.00	112.77	6+01.00	113.01	54	CIRCULAR	601.00	0.000399	15.90	.015	34.16	22.08
8	WIN	6+01.00	113.01	46+25.00	115.03	48	CIRCULAR	4021.00	0.000502	12.57	.015	27.89	18.02
8	WIN	46+25.00	115.03	46+32.05	115.03		REDUCER	7.05					
9	WIN	0+00.00	115.03	23+02.00	117.18	42	CIRCULAR	2302.00	0.000933	9.62	.015	26.64	17.22
9	WIN	23+02.00	117.18	47+85.00	118.73	36	CIRCULAR	2483.00	0.000624	7.07	.015	14.53	9.39
9	WIN	47+85.00	118.73	48+50.00	118.94	2-20	CIRCULAR	65.00	0.003230	4.36	.015	12.80	9.27
9	WIN	48+50.00	118.94	49+56.00	119.00	36	CIRCULAR	106.00	0.000566	7.07	.015	13.78	8.91
9	WIN	49+56.00	119.00	49+66.76	120.22		REDUCER	10.76	0.113382				
70	WIN	0+00.00	120.22	10+30.00	122.79	24X36	OVAL	1030.00	0.002495	4.72	.016	15.82	10.22
70	WIN	10+30.00	122.79	14+00.00	136.00	24X36	OVAL	370.00	0.035702	4.72	.016	59.78	38.63
70	WIN	14+00.00	136.00	19+00.00	161.00	24X36	OVAL	500.00	0.030000	4.72	.016	54.80	35.42

TABLE A-1 MCC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
70	WIN	19+00.00	161.00	23+55.00	164.70	24X36	OVAL	455.00	0.008131	4.72	.016	28.53	18.44
70	WIN	23+55.00	164.70	35+34.87	166.20	24X36	OVAL	1179.87	0.001271	4.72	.016	11.28	7.29
71	WIN	0+00.00	118.90	30+21.00	122.25	30	CIRCULAR	3021.00	0.001108	4.91	.015	11.87	7.67
71	WIN	30+21.00	122.25	33+44.00	127.95	30	CIRCULAR	323.00	0.017647	4.91	.015	47.31	30.58
71	WIN	33+44.00	127.95	40+41.45	128.65	30	CIRCULAR	697.45	0.001003	4.91	.015	11.26	7.28
72	WIN WOB	0+00.00	128.65	23+60.00	130.75	30X31	OVAL	2360.00	0.000889	5.12	.015	10.49	5.78
72	WIN WOB	23+60.00	130.75	25+42.00	131.96	20	CIRCULAR	182.00	0.006648	2.18	.015	9.90	6.40
72	WIN WOB	25+42.00	131.96	26+70.00	132.70	20	CIRCULAR	128.00	0.005781	2.18	.015	9.23	5.97
72	WIN WOB	26+70.00	132.70	34+76.34	135.00	20	CIRCULAR	806.34	0.000372	2.18	.015	2.34	1.51
73	WOB SHM	0+00.00	135.00	0+00.00	133.40		DROP MANHOLE						
73	WOB SHM	0+00.00	133.40	2+01.00	137.44	18	CIRCULAR	201.00	0.012139	1.77	.015	10.00	6.46
73	WOB SHM	2+01.00	137.44	11+64.00	142.26	18	CIRCULAR	963.00	0.005005	1.77	.015	6.44	4.16
73	WOB SHM	11+64.00	142.26	23+10.00	149.00	18	CIRCULAR	1146.00	0.005881	1.77	.015	6.99	4.52
73	WOB SHM	23+10.00	145.00	23+10.00	152.00		DROP MANHOLE						
73	WOB SHM	23+10.00	152.00	30+30.00	157.50	18	CIRCULAR	720.00	0.007638	1.77	.015	7.97	5.15
73	WOB SHM	30+30.00	157.50	36+00.00	166.35	15	CIRCULAR	570.00	0.015526	1.23	.015	6.98	4.51
74	SHM	0+00.00	166.35	3+85.00	172.27	15	CIRCULAR	385.00	0.015376	1.23	.015	6.95	4.49
74	SHM	3+85.00	172.27	14+43.00	181.47	18	CIRCULAR	1058.00	0.008695	1.77	.015	8.50	5.49
74	SHM	14+43.00	181.47	31+63.65	187.62	20	CIRCULAR	1720.65	0.003574	2.18	.015	7.26	4.69
75	SHM WIN	0+00.00	187.62	1+96.00	188.32	20	CIRCULAR	196.00	0.003571	2.18	.015	7.25	4.69
75	SHM WIN	1+96.00	188.32	5+75.00	194.65	15	CIRCULAR	379.00	0.016701	1.23	.015	7.24	4.68
75	SHM WIN	5+75.00	194.65	13+00.00	196.72	20	CIRCULAR	725.00	0.002855	2.18	.015	6.48	4.19

TABLE A-1 MCC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
75	SHM WIN	13+00.00	196.72	22+25.00	206.47	18	CIRCULAR	925.00	0.010540	1.77	.015	9.36	6.05
75	SHM WIN	22+25.00	206.47	25+67.00	210.73	18	CIRCULAR	342.00	0.012456	1.77	.015	10.17	6.57
75	SHM WIN	25+67.00	210.73	34+91.00	214.81	20	CIRCULAR	924.00	0.004415	2.18	.015	8.06	5.21
75	SHM WIN	34+91.00	214.81	34+91.00	220.11		DROP MANHOLE						
75	SHM WIN	34+91.00	220.11	37+62.00	224.26	15	CIRCULAR	271.00	0.015313	1.23	.015	6.94	4.49
75	SHM WIN	37+62.00	224.26	51+22.00	228.14	20	CIRCULAR	1360.00	0.002852	2.18	.015	6.48	4.19
75	SHM WIN	51+22.00	228.14	51+46.00	228.54	16	CIRCULAR	24.00	0.016667	1.40	.015	8.54	5.52
75	SHM WIN	51+46.00	228.54	52+77.31	228.91	20	CIRCULAR	131.31	0.002817	2.18	.015	5.45	4.17
75	SHM WIN	52+77.31	228.91	52+77.31	229.25		DROP MANHOLE						
75	SHM WIN	52+77.31	229.25	54+56.28	229.25	20	CIRCULAR	178.97		2.18	.015		
76	WAK REA	11+47.50	229.25	25+00.00	201.38	16FM	CIRCULAR	1352.50		1.40	.015		
76	WAK REA	25+00.00	201.38	25+50.00	164.80		PUMP STATION	50.00					
76	WAK REA	25+50.00	164.80	26+46.70	173.80	36	CIRCULAR	96.70	0.093071	7.07	.015	176.70	114.20
76	WAK REA	26+46.70	173.80	40+05.17	174.70	24X27	EXT. CIRCLE	1358.47	0.000662	3.64	.015	6.16	3.98
77	ARL	0+00.00	109.30	25+71.00	110.33	36X42	EXT. CIRCLE	2571.00	0.000400	8.57	.016	14.00	9.05
77	ARL	25+71.00	110.33	30+98.55	110.54	2-30	CIRCULAR	527.55	0.000398	9.82	.016	13.34	8.62
78	MFD ARL	0+00.00	110.54	0+37.50	110.55	2-30	CIRCULAR	37.50	0.000266	9.82	.016	10.88	7.03
78	MFD ARL	0+37.50	110.55	2+18.24	111.25	16,20	SIPHON	180.74	0.003872	3.58	.016	9.55	6.17
78	MFD ARL	2+18.24	111.25	5+47.00	111.38	2-30	CIRCULAR	328.76	0.000395	9.82	.016	13.34	8.62
78	MFD ARL	5+47.00	111.38	38+28.52	112.49	36X42	EXT. CIRCLE	2781.52	0.000399	8.57	.016	14.00	9.05
79	ARL	0+00.00	118.50	2+21.00	124.07	20	CIRCULAR	221.00	0.025203	2.18	.015	19.27	12.45
79	ARL	2+21.00	124.07	10+72.00	126.19	24	CIRCULAR	851.00	0.002491	3.14	.015	9.80	6.33

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
79	ARL	10+72.00	126.19	17+60.95	133.83	20	CIRCULAR	688.95	0.011089	2.18	.015	12.78	8.26
79	ARL	17+60.95	133.83	29+00.00	139.83	24	CIRCULAR	1139.05	0.005267	3.14	.015	14.25	9.21
79	ARL	29+00.00	139.83	33+98.00	149.43	20	CIRCULAR	498.00	0.019277	2.18	.015	16.86	10.90
79	ARL	33+98.00	149.43	35+23.00	153.22	20	CIRCULAR	125.00	0.030320	2.18	.015	21.14	13.66
79	ARL	35+23.00	153.22	37+93.00	155.00	20	CIRCULAR	270.00	0.006592	2.18	.015	9.86	5.37
79	ARL	0+00.00	113.43	3+95.00	113.92	20	CIRCULAR	395.00	0.001240	2.18	.015	4.27	2.76
79	ARL	3+95.00	113.92	4+37.00	114.77	2-10	CIRCULAR	42.00	0.020238	1.10	.015	5.33	3.44
79	ARL	4+37.00	114.77	12+61.80	115.80	20	CIRCULAR	824.80	0.001248	2.18	.015	4.27	2.76
80	ARL	0+00.00	155.00	0+23.00	155.16	24	CIRCULAR	23.00	0.006956	3.14	.015	16.38	10.59
80	ARL	0+23.00	155.16	0+45.00	155.32	2-24	CIRCULAR	22.00	0.007272	6.28	.015	33.50	21.65
80	ARL	0+45.00	155.32	0+62.00	155.44	24	CIRCULAR	17.00	0.007058	3.14	.015	16.50	10.66
80	ARL	0+62.00	155.44	2+42.00	158.43	20	CIRCULAR	180.00	0.016611	2.18	.015	15.65	10.11
80	ARL	2+42.00	158.43	6+67.00	165.97	20	CIRCULAR	425.00	0.017741	2.18	.015	15.17	10.45
80	ARL	6+67.00	165.97	13+91.00	173.00	20	CIRCULAR	724.00	0.009709	2.18	.015	11.96	7.73
80	ARL	13+91.00	173.00	15+81.00	177.50	20	CIRCULAR	190.00	0.023684	2.18	.015	18.68	12.07
80	ARL	15+81.00	177.50	16+85.00	178.54	24	CIRCULAR	104.00	0.010000	3.14	.015	19.64	12.69
80	ARL	16+85.00	178.54	18+10.00	181.00	20	CIRCULAR	125.00	0.019680	2.18	.015	17.03	11.01
80	ARL	18+10.00	181.00	21+94.00	184.07	20	CIRCULAR	384.00	0.007995	2.18	.015	10.85	7.01
80	ARL	21+94.00	184.07	24+09.00	185.50	24	CIRCULAR	215.00	0.006651	3.14	.015	16.02	10.35
80	ARL	24+09.00	185.50	24+09.00	186.50		DROP MANHOLE						
80	ARL	24+09.00	186.50	29+15.00	195.53	20	CIRCULAR	506.00	0.017845	2.18	.015	16.20	10.47
80	ARL	29+15.00	195.53	30+98.00	204.90	20	CIRCULAR	183.00	0.051202	2.18	.015	27.48	17.76

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
80R	ARL	0+00.00	186.50	1+55.00	193.40	12	CIRCULAR	155.00	0.044516	.79	.015	6.52	4.21
80R	ARL	1+55.00	193.40	3+80.00	202.84	12	CIRCULAR	225.00	0.044516	.79	.015	6.52	4.21
81	BLM	0+00.00	103.46	31+41.00	106.89	30	CIRCULAR	3141.00	0.001092	4.91	.015	11.09	7.17
81	BLM	31+41.00	106.89	0+34.82	107.20	30	CIRCULAR	341.00	0.000909	4.91	.015	10.12	6.54
81	BLM	34+82.00	107.20	35+04.00	107.24	3-16	CIRCULAR	22.00	0.001818	4.20	.015	8.46	5.47
81	BLM	35+04.00	107.24	35+80.00	107.39	30	CIRCULAR	76.00	0.001973	4.91	.015	14.91	9.64
82	ARL	0+00.00	204.95	8+78.00	210.80	20	CIRCULAR	878.00	0.006662	2.18	.015	9.91	6.40
82	ARL	8+78.00	210.80	8+78.00	215.45		DROP MANHOLE						
82	ARL	8+78.00	215.45	11+45.00	220.82	20	CIRCULAR	267.00	0.020112	2.18	.015	17.22	11.13
82	ARL	11+45.00	220.82	11+98.00	228.65	20	CIRCULAR	53.00	0.147735	2.18	.015	46.67	30.16
82	ARL	11+98.00	228.65	13+85.00	232.34	20	CIRCULAR	187.00	0.019732	2.19	.015	17.05	11.02
82	ARL	13+85.00	232.34	13+85.00	238.46		DROP MANHOLE						
82	ARL	13+85.00	238.46	21+24.00	243.25	20	CIRCULAR	739.00	0.006481	2.18	.015	9.77	6.31
83	ARL LFX	0+00.00	243.29	25+12.88	253.34	20	CIRCULAR	2512.88	0.003999	2.18	.015	7.68	4.96
84	LFX	0+00.00	253.51	3+25.00	253.91	33	CIRCULAR	325.00	0.001230	5.94	.015	15.10	10.41
84	LFX	3+25.00	253.91	4+40.00	254.86	1-12.2-21	SIPHON	115.00	0.008260	5.61	.015	20.85	13.47
84	LFX	4+40.00	254.86	11+71.70	255.87	33	CIRCULAR	731.70	0.001380	5.94	.015	17.06	11.03
85	LFX	0+00.00	255.87	33+40.00	260.23	33	CIRCULAR	3340.00	0.001305	5.94	.015	16.50	10.66
85	LFX	33+40.00	260.23	33+40.00	260.48		DROP MANHOLE						
85	LFX	33+40.00	260.48	66+53.00	266.26	30	CIRCULAR	3313.00	0.001744	4.91	.015	14.87	9.61
85	LFX	66+53.00	266.26	66+53.00	266.36		O O O P P P				.01		
85	LFX	66+53.00	266.36	116+72.48	274.11	30	CIRCULAR	5019.42	0.001543	4.91	.015	13.90	8.98

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
86	WIN	0+00.00	118.02	3+43.00	119.45	30	CIRCULAR	343.00	0.004169	4.91	.016	21.55	13.93
86	WIN	3+43.00	119.45	49+67.26	132.66	30	CIRCULAR	4624.26	0.002640	4.91	.016	17.15	11.08
87	MAL EVE	0+00.00	92.32	82+15.00	98.40	54	CIRCULAR	8215.00	0.000740	15.90	.015	46.49	30.05
88	WOB	0+00.00	129.86	66+45.00	137.86	48	CIRCULAR	6645.00	0.001205	12.57	.015	43.30	27.98
88	WOB	66+45.00	137.86	66+45.00	138.36		DROP MANHOLE						
88	WOB	66+45.00	138.36	66+84.82	138.42	42	CIRCULAR	39.82	0.001506	9.62	.015	33.91	21.92
89	WOB	0+00.00	138.42	42+18.00	144.90	42	CIRCULAR	4218.00	0.001536	9.62	.015	34.26	22.14
89	WOB	42+18.00	144.90	42+18.00	145.40		DROP MANHOLE						
89	WOB	42+18.00	145.40	50+84.71	147.58	36	CIRCULAR	866.71	0.002515	7.07	.015	29.04	18.77
90	WOB WIL	0+00.00	147.58	36+86.00	156.50	36	CIRCULAR	3686.00	0.002419	7.07	.015	28.50	18.42
90	WOB WIL	36+86.00	156.50	36+86.00	157.01		DROP MANHOLE						
90	WOB WIL	36+86.00	157.01	44+40.00	158.83	30	CIRCULAR	754.00	0.002413	4.91	.015	17.52	11.32
90	WOB WIL	44+40.00	158.83	58+24.00	162.95	30	CIRCULAR	1384.00	0.002976	4.91	.015	19.43	12.56
90	WOB WIL	58+24.00	162.95	73+47.00	168.20	30	CIRCULAR	1523.00	0.003448	4.91	.015	20.91	13.51
90	WOB WIL	73+47.00	168.20	86+60.00	170.59	30	CIRCULAR	1313.00	0.001818	4.91	.015	15.18	9.81
91A	MFD	0+00.00	105.00	8+41.00	105.48	66	CIRCULAR	841.00	0.000570	23.76	.015	69.60	44.98
91A	MFD	8+41.00	105.48	8+41.00	105.98		DROP MANHOLE						
91A	MFD	8+41.00	105.98	31+06.00	107.25	60	CIRCULAR	2265.00	0.000564	19.64	.015	53.70	34.71
91B	MFD ARL	31+06.00	107.25	31+16.00	107.26	60	CIRCULAR	10.00	0.001000	19.64	.015	71.53	46.23
91B	MFD ARL	31+16.00	107.26	37+10.00	109.80	2-33	SIPHON	594.00	0.004276	11.88	.015	51.29	33.15
91B	MFD ARL	37+10.00	105.80	64+43.00	121.80	54	CIRCULAR	2733.00	0.004390	15.90	.015	113.10	73.09
92	ARL	0+00.00	121.80	0+00.00	127.50		DROP MANHOLE						

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	CAPACITY (MGD)
92	ARL	0+00.00	127.50	39+90.00	162.09	42	CIRCULAR	3990.00	0.008669	9.62	.015	81.30	52.54
92	ARL	39+90.00	162.09	39+90.00	162.59		DROP MANHOLE						
92	ARL	39+90.00	162.59	58+40.00	187.68	36	CIRCULAR	1850.00	0.013562	7.07	.015	57.40	43.56
93	ARL LEX	0+00.00	187.68	21+21.00	205.10	36	CIRCULAR	2121.00	0.008213	7.07	.015	52.49	33.92
93	ARL LEX	21+21.00	205.10	21+28.00	209.72	36	CIRCULAR	7.00	0.660000	7.07	.015	470.50	304.07
93	ARL LEX	21+28.00	209.72	22+51.00	210.24	36	CIRCULAR	123.00	0.004228	7.07	.015	37.66	24.34
93	ARL LEX	22+51.00	210.24	22+59.00	213.35	36	CIRCULAR	8.00	0.388750	7.07	.015	361.10	233.37
93	ARL LEX	22+59.00	213.35	24+91.00	214.31	36	CIRCULAR	232.00	0.004138	7.07	.015	37.20	24.04
93	ARL LEX	24+91.00	214.31	24+91.00	221.00		DROP MANHOLE						
93	ARL LEX	24+91.00	221.00	25+22.50	221.06	36	CIRCULAR	31.50	0.001905	7.07	.015	25.20	15.29
93	ARL LEX	25+22.50	221.06	25+22.50	230.37		DROP MANHOLE						
93	ARL LEX	25+22.50	230.37	26+95.00	231.05	36	CIRCULAR	172.50	0.003942	7.07	.015	35.30	23.46
93	ARL LEX	26+95.00	231.05	26+95.00	239.92		DROP MANHOLE						
93	ARL LEX	26+95.00	239.92	60+16.00	253.09	36	CIRCULAR	3321.00	0.003966	7.07	.015	36.40	23.52
95A	MAL	0+09.70	98.41	0+86.80	98.44	53X34	RECTANGULAR	77.10	0.000389	12.51	.013	25.68	16.60
95A	MAL	0+86.80	98.44	2+93.20	98.51	48	CIRCULAR	206.40	0.000339	12.57	.013	26.50	17.13
95	MAL	3+03.75	98.53	7+30.00	98.91	42	CIRCULAR	426.25	0.000891	9.62	.013	30.09	19.45
95	MAL	7+30.00	98.91	11+27.63	99.26	42	CIRCULAR	397.63	0.000880	9.62	.013	29.90	19.32
95	MAL	11+27.63	99.26	11+27.63	99.34		DROP MANHOLE						
95	MAL	11+27.63	99.34	16+25.00	99.64	36	CIRCULAR	497.37	0.000603	7.07	.013	15.40	10.60
95	MAL	16+25.00	99.64	24+05.00	100.17	36	CIRCULAR	783.00	0.000679	7.07	.013	17.41	11.25
95	MAL	24+05.00	100.17	33+20.00	100.72	36	CIRCULAR	915.00	0.000601	7.07	.013	16.38	10.59

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
95	MAL	33+20.00	100.72	46+12.94	101.54	36	CIRCULAR	1292.94	0.000634	7.07	.013	16.80	10.86
95	MAL	46+12.94	101.54	46+12.94	102.39		DROP MANHOLE						
95	MAL	46+12.94	102.39	53+89.69	103.98	27	CIRCULAR	776.75	0.002047	3.98	.013	14.00	9.05
95	MAL	53+89.69	103.98	53+89.69	104.08		DROP MANHOLE						
95	MAL	53+89.69	104.08	72+35.15	106.88	27	CIRCULAR	1845.46	0.001517	3.98	.013	12.00	7.76
95	MAL	72+35.15	106.88	72+35.15	107.26		DROP MANHOLE						
95	MAL	72+35.15	107.26	77+52.13	108.04	27	CIRCULAR	516.98	0.001509	3.98	.013	12.00	7.76
95	MAL	77+52.13	108.04	77+52.13	108.39		DROP MANHOLE						
95	MAL	77+52.13	108.39	92+88.72	111.00	24	CIRCULAR	1536.59	0.001699	3.14	.013	9.34	6.04
101	CHL EB	0+00.00	38.47	10+00.00	38.47	3-60	SIPHON	1000.00		58.92	.016		
101	CHL EB	10+00.00	38.47	10+00.00	78.83		DROP MANHOLE						
101	CHL EB	10+00.00	78.83	12+04.23	78.94	135X135	HORSESHOE	204.23	0.000538	102.25	.015	474.10	306.40
102	CHL	0+00.00	78.34	6+50.00	79.27	135X135	HORSESHOE	650.00	0.000500	102.25	.015	457.10	295.41
102	CHL	6+50.00	79.27	43+10.00	81.10	135	CIRCULAR	3660.00	0.000500	99.40	.015	439.80	284.23
103	EVE CHL	0+00.00	81.10	37+00.00	82.95	135	CIRCULAR	3700.00	0.000500	99.40	.015	439.80	284.23
104A	EVE	0+00.00	82.95	21+36.00	84.01	135X135	HORSESHOE	2136.00	0.000500	102.25	.015	457.10	295.41
104B	EVE	0+00.00	84.01	7+90.00	84.41	135	CIRCULAR	790.00	0.000500	99.40	.015	439.80	284.23
104B	EVE	7+90.00	84.41	22+92.00	85.91	126	CIRCULAR	1502.00	0.000998	86.59	.015	516.90	334.06
105	MED EVE	0+00.00	85.91	5+00.00	85.91	126	CIRCULAR	500.00	0.000500	86.59	.015	365.90	236.47
105	MED EVE	5+00.00	86.16	5+05.00	86.17		TRANSITION	5.00	0.001333				
105		5+05.00	86.17	5+25.00	86.19	126X84	RECTANGULAR	20.00	0.001333	73.50	.015	436.70	282.23
105		5+25.00	86.19	5+30.00	86.20		TRANSITION	5.00	0.001333				

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
105	MFD EVE	5+30.00	86.20	15+80.00	86.72	126X126	HORSESHOE	1050.00	0.000500	88.60	.015	377.50	243.97
105	MFD EVE	15+80.00	86.72	15+80.00	87.97		DROP MANHOLE						
105	MFD EVE	15+80.00	87.97	27+86.00	88.61	111X111	HORSESHOE	1206.00	0.000530	69.24	.015	279.80	180.83
105	MFD EVE	27+86.00	88.61	31+89.00	89.69	2-42X80	SIPHON	403.00	0.002679	41.40	.015	145.90	94.29
105	MFD EVE	31+89.00	89.69	40+03.00	90.36	111X111	HORSESHOE	814.00	0.000823	69.24	.015	348.60	225.29
105	MFD EVE	40+03.00	90.36	42+23.00	90.47	111	CIRCULAR	220.00	0.000500	67.20	.015	261.10	168.74
105	MFD EVE	42+23.00	90.47	42+45.00	90.48	111X111	HORSESHOE	22.00	0.000454	69.24	.015	258.90	167.32
105	MFD EVE	42+45.00	90.48	42+45.00	91.24		DROP MANHOLE						
105	MFD EVE	42+45.00	91.24	64+99.15	92.36	102X102	HORSESHOE	2254.15	0.000500	58.45	.015	215.80	140.11
106A	MFD	0+00.00	92.36	20+50.00	93.38	102X102	HORSESHOE	2050.00	0.000500	58.45	.015	216.80	140.11
106A	MFD	20+50.00	93.38	24+02.00	94.18	3-54	SIPHON	352.00	0.002272	47.70	.015	177.20	114.52
106A	MFD	0+24.02	94.18	47+55.39	95.33	102X102	HORSESHOE	2353.39	0.000488	58.45	.015	214.20	138.43
106	MFD	0+00.00	95.32	30+00.00	96.81	102X102	HORSESHOE	3000.00	0.000500	58.45	.015	216.80	140.11
107	MFD	0+00.00	96.81	18+70.00	97.75	102X102	HORSESHOE	1870.00	0.000500	58.45	.015	215.80	140.11
107	MFD	18+70.00	97.75	20+06.00	97.81	3-54	SIPHON	136.00	0.000441	47.70	.015	61.00	39.42
107	MFD	20+06.00	97.81	26+90.00	98.51	102X102	HORSESHOE	684.00	0.001023	58.45	.015	310.20	200.48
107	MFD	26+90.00	98.51	27+80.00	98.55	3-54	SIPHON	110.00	0.000363	47.70	.015	53.21	34.39
107	MFD	27+80.00	98.55	33+53.96	98.84	102X102	HORSESHOE	573.96	0.000500	58.45	.015	215.80	140.11
108	MFD	0+00.00	98.84	13+72.00	99.53	102X102	HORSESHOE	1372.00	0.000500	58.45	.015	215.80	140.11
108	MFD	13+72.00	99.53	13+72.00	100.53		DROP MANHOLE						
108	MFD	13+72.00	100.53	22+70.00	100.97	90X90	HORSESHOE	898.00	0.000489	45.51	.015	153.30	99.07
108	MFD	22+70.00	100.97	33+00.00	101.49	93	CIRCULAR	1030.00	0.000500	47.17	.015	162.70	105.15

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
109	MFD	0+00.00	108.12	25+15.00	108.93	72X75	EXT. CIRCLE	2515.00	0.000322	29.77	.016	66.38	42.90
109	MFD	25+15.00	108.93	25+44.83	109.00	60X63	EXT. CIRCLE	129.83	0.000539	20.89	.016	53.55	34.61
110	MFD	0+00.00	109.00	36+96.00	110.48	60X63	EXT. CIRCLE	3696.00	0.000400	20.89	.016	46.13	29.81
111	MFD	0+00.00	102.24	3+00.00	102.45	78X81	EXT. CIRCLE	300.00	0.000700	34.81	.016	120.50	77.88
111	MFD	3+00.00	102.45	3+00.00	103.20		DROP MANHOLE						
111	MFD	0+30.00	103.20	17+00.00	104.17	72	CIRCULAR	1400.00	0.000689	28.27	.016	96.56	62.40
111	MFD	17+00.00	104.17	18+65.00	104.28	72X75	EXT. CIRCLE	165.00	0.000666	29.77	.016	94.20	60.88
111	MFD	18+65.00	104.28	18+65.00	104.78		DROP MANHOLE						
111	MFD	18+65.00	104.78	56+14.65	107.36	66X69	EXT. CIRCLE	3749.65	0.000689	25.13	.016	77.40	50.02
112	MFD WIN	0+00.00	107.36	22+70.00	107.96	66	CIRCULAR	2270.00	0.000264	23.75	.016	44.43	28.71
112	MFD WIN	22+70.00	107.96	49+93.97	110.80	66X69	EXT. CIRCLE	2723.97	0.001042	25.13	.016	95.29	61.58
113	WIN	0+00.00	110.80	34+34.00	113.51	66X69	EXT. CIRCLE	3434.00	0.000789	25.13	.016	82.92	53.59
113	WIN	34+34.00	113.51	36+70.00	113.67	66	CIRCULAR	236.00	0.000677	23.76	.016	71.15	45.98
113	WIN	36+70.00	113.67	42+70.48	114.08	66X69	EXT. CIRCLE	600.48	0.000689	25.13	.016	77.48	50.07
114	WIN	0+00.00	114.08	44+21.00	117.11	66X69	EXT. CIRCLE	4421.00	0.000689	25.13	.016	77.40	50.02
114	WIN	44+21.00	117.11	44+21.00	118.44		DROP MANHOLE						
114	WIN	44+21.00	118.44	62+97.46	121.79	50X53	EXT. CIRCLE	1876.46	0.001780	14.68	.016	60.59	39.16
115A	WIN SHM	0+00.00	121.79	38+70.00	128.74	50X53	EXT. CIRCLE	3870.00	0.001790	14.68	.016	60.76	39.27
115A	WIN SHM	38+70.00	128.74	38+70.00	125.74		DROP MANHOLE						
115A	WIN SHM	38+70.00	125.74	39+73.00	126.74		CHAMBER	103.00	0.009709				
115A	WIN SHM	39+73.00	126.84	397+31.00	28.74		DROP MANHOLE						
115A	WIN SHM	39+73.00	126.84	45+43.00	129.89	50X53	EXT. CIRCLE	570.00	0.001842	14.68	.016	62.00	40.07

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	CAPACITY (MGD)
115A	WON SHM	45+43.00	129.89	45+43.00	131.05		DROP MANHOLE						
115A	WIN SHM	45+43.00	131.05	71+98.00	139.87	36	CIRCULAR	2655.00	0.003322	7.07	.015	33.30	21.52
115A	WIN SHM	71+98.00	139.87	71+98.00	148.33		DROP MANHOLE						
115A	WIN SHM	71+98.00	148.33	78+45.82	150.50	36	CIRCULAR	647.82	0.003349	7.07	.015	33.52	21.66
115B	SHM	78+45.82	150.50	84+44.00	152.50	36	CIRCULAR	598.18	0.003343	7.07	.015	33.40	21.59
115B	SHM	84+44.00	152.50	84+44.00	159.03		DROP MANHOLE						
115B	SHM	84+44.00	159.03	90+42.00	168.85	36	CIRCULAR	598.00	0.016421	7.07	.015	74.22	47.97
115B	SHM	90+42.00	168.85	100+01.00	172.21	36	CIRCULAR	959.00	0.003503	7.07	.015	34.20	22.10
115B	SHM	100+01.00	172.21	100+01.00	174.69		DROP MANHOLE						
115B	SHM	100+01.00	174.69	136+09.00	191.66	36	CIRCULAR	3608.00	0.004703	7.07	.015	39.70	25.66
115B	SHM	136+09.00	191.66	136+09.00	197.02		DROP MANHOLE						
115B	SHM	136+09.00	197.02	147+38.00	200.77	36	CIRCULAR	1129.00	0.003321	7.07	.015	32.80	21.20
207A	CAM	6+77.55	97.80	6+92.55	93.45		TRANSITION	15.00					
207A	CAM	6+92.55	93.45	17+10.00	94.26	98X73.50	HORSESHOE	1017.45	0.000796	42.85	.013	208.40	134.68
207A	CAM	17+10.00	94.26	23+85.00	94.76	98X73.50	HORSESHOE	675.00	0.000740	42.85	.013	201.00	129.90
207B	CAM	23+85.00	94.76	27+80.00	95.09	98X73.50	HORSESHOE	395.00	0.000835	42.85	.013	213.50	137.98
207B	CAM	27+80.00	95.09	36+00.00	95.71	98X73.50	HORSESHOE	820.00	0.000756	42.85	.013	202.70	131.00
207B	CAM	36+00.00	95.71	38+36.41	95.88	124X49	HORSESHOE	236.41	0.000719	39.00	.013	167.10	107.99
207B	CAM	38+36.41	95.88	45+00.00	96.38	124X49	HORSESHOE	663.59	0.000753	39.00	.013	171.00	110.51
207B	CAM	45+00.00	96.38	47+65.00	97.00	124X49	HORSESHOE	265.00	0.002339	39.00	.013	301.40	194.79
207B	CAM	47+65.00	97.00	48+60.00	97.06	92X70	HORSESHOE	95.00	0.000631	39.07	.013	164.10	106.05
207B	CAM	48+60.00	97.06	56+34.83	97.60	92X70	HORSESHOE	774.83	0.000696	39.07	.013	172.30	111.35

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
207B	CAM	56+34.83	97.60	57+00.00	97.78	92X70	HORSESHOE	65.17	0.002762	39.07	.013	343.30	221.87
207B	CAM	57+00.00	97.78	64+25.58	98.25	92X70	HORSESHOE	725.58	0.000647	39.07	.013	166.10	107.35
207B	CAM	64+25.58	98.25	64+39.58	99.00		DROP MANHOLE	14.00					
207B	CAM	64+39.58	99.00	64+89.58	99.04	60	CIRCULAR	50.00	0.000750	19.64	.013	71.48	46.20
209	CAM	0+00.00	92.90	0+90.00	92.94	60	CIRCULAR	90.00	0.000444	19.64	.013	55.00	35.55
209	CAM	0+90.00	92.94	1+75.00	92.99	60	CIRCULAR	85.00	0.000600	19.64	.013	63.90	41.30
209	CAM	1+75.00	92.99	1+75.00	93.01		DROP MANHOLE						
209	CAM	1+75.00	93.01	11+50.00	93.54	60	CIRCULAR	975.00	0.000543	19.64	.013	60.82	39.31
209	CAM	11+50.00	93.54	13+12.18	93.63	60	CIRCULAR	162.18	0.000554	19.64	.013	61.43	39.70
209	CAM	13+12.18	93.63	19+26.00	93.94	60	CIRCULAR	613.82	0.000505	19.64	.013	58.50	37.87
209	CAM	19+26.00	93.94	19+26.00	94.35		DROP MANHOLE						
209	CAM	19+26.00	94.35	21+12.00	94.47	54	CIRCULAR	186.00	0.000645	15.90	.013	50.00	32.31
209	CAM	21+12.00	94.47	25+00.00	94.73	54	CIRCULAR	388.00	0.000670	15.90	.013	51.00	32.96
209	CAM	25+00.00	94.73	25+00.00	94.77		DROP MANHOLE						
209	CAM	25+00.00	94.77	31+16.00	95.13	54	CIRCULAR	616.00	0.000584	15.90	.013	47.60	30.76
209	CAM	31+16.00	95.13	35+00.00	95.36	54	CIRCULAR	384.00	0.000598	15.90	.013	48.10	31.09
209	CAM	35+00.00	95.36	35+00.00	96.54		DROP MANHOLE						
209	CAM	35+00.00	96.54	41+30.00	97.03	36	CIRCULAR	630.00	0.000777	7.07	.013	18.60	12.02
209	CAM	41+30.00	97.03	47+77.66	97.55	36	CIRCULAR	647.66	0.000802	7.07	.013	18.90	12.21
209	CAM	47+77.66	97.55	47+77.66	98.05		DROP MANHOLE						
209	CAM	47+77.66	98.05	50+80.00	98.41	30	CIRCULAR	302.34	0.001190	4.91	.013	14.10	9.11
209	CAM	50+80.00	98.41	59+07.00	99.39	30	CIRCULAR	827.00	0.001185	4.91	.013	14.14	9.14

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
204A	BOS	80+95.45	86.90	81+27.48	86.91	108	CIRCULAR	32.03	0.000349	63.62	.013	234.10	151.29
204A	BOS	81+27.48	86.91	0+81.35	88.42		DROP MANHOLE	8.00					
204A	CRC	81+35.48	88.42	86+90.00	88.80	60	CIRCULAR	554.52	0.000690	19.64	.013	59.42	38.40
204A	CAM	86+90.00	88.80	86+97.00	88.90		DROP MANHOLE						
204A	CAM	86+97.00	88.90	87+61.00	89.85	60	CIRCULAR	64.00	0.000781	19.64	.013	63.22	40.86
204A	CAM	87+61.00	89.85	87+95.00	89.95		CHAMBER	34.00	0.002941				
204A	CAM	87+95.00	89.95	88+15.00	89.96	88X138	HORSESHOE	20.00	0.000500	66.27	.013	295.50	190.98
204A	CAM	88+15.00	89.96	88+23.00	92.02	88X138	HORSESHOE	8.00	0.257500	66.27	.013		
204A	CAM	88+23.00	92.02	92+91.82	92.25	88X138	HORSESHOE	468.82	0.000500	66.27	.013	295.50	190.98
204A	CAM	92+91.82	92.25	93+13.32	92.55		CHAMBER	21.50					
204A	CAM	93+13.32	92.55	94+93.00	92.66	84X108	HORSESHOE	179.68	0.000600	52.05	.013	169.90	109.80
204A	CAM	0+18.50	92.90	0+88.50	92.94	60	CIRCULAR	70.00	0.000600	19.64	.013	55.41	35.81
204B	CRC	81+35.48	88.43	87+15.03	88.88	72	CIRCULAR	579.55	0.000770	28.27	.013	125.60	81.17
204B	CAM	19+04.97	88.88	19+37.34	88.90	72	CIRCULAR	32.37	0.000770	28.27	.013	125.60	81.17
204B	CAM	19+37.34	88.90	19+70.34	88.91		CHAMBER	33.00					
204B	CAM	87+10.64	83.60	87+21.14	87.50		DROP MANHOLE						
204C	CRC	87+21.14	87.50	81+34.48	88.50	54	CIRCULAR	586.66	0.001800	15.90	.013	83.56	54.00
204C	BOS	81+34.48	88.50	81+40.58	98.00		DROP MANHOLE						
204C	BOS	0+07.75	98.00	1+51.08	98.48	54	CIRCULAR	143.33	0.003349	15.90	.013	113.90	73.61
204D	BOS	0+07.75	86.82	0+07.75	98.04		DROP MANHOLE						
204D	BOS	0+07.75	98.04	1+51.08	98.48	30	CIRCULAR	143.33	0.003349	4.91	.013	23.65	15.28
MVS	WOB MFD	3+32.00	113.00	61+46.11	119.06	26X28	EXT. CIRCLE	5814.11	0.001042	4.05	.016	8.33	5.38

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NC	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
MVS	WOB MFD	61+46.11	119.06	61+46.11	123.94		DROP MANHOLE						
MVS	WOB MFD	61+46.11	123.94	117+72.91	128.34	26X28	EXT. CIRCLE	5626.81	0.000782	4.05	.016	7.21	4.66
MVS	WOB MFD	117+72.91	128.34	117+72.91	129.34		DROP MANHOLE						
MVS	WOB MFD	0+00.00	129.34	2+34.78	147.51	15	CIRCULAR	234.78	0.077391	1.23	.015	15.50	10.08
MVS	WOB MFD	2+34.78	147.51	19+11.25	164.26	15	CIRCULAR	1676.47	0.009991	1.23	.015	5.60	3.62
MVS	WOB MFD	19+11.25	164.26	28+77.25	172.38	15	CIRCULAR	966.00	0.008405	1.23	.015	5.14	3.32
ABC	CAM ARL	0+23.00	104.76	0+43.00	104.76		CHAMBER	20.00					
ABC	SOM MFD	0+43.00	104.76	2+50.00	104.62	48	CIRCULAR	207.00	0.000676	12.57	.015	32.43	20.96
ABC	SOM MFD	2+50.00	104.62	3+45.00	104.56	48	SIPHON	95.00	0.000631	12.57	.015	16.64	10.75
ABC	SOM MFD	3+45.00	104.56	28+36.00	96.51	48	CIRCULAR	2491.00	0.003232	12.57	.015	70.92	45.83
ABC	SOM MFD	28+36.00	96.51	28+50.00	102.96		REDUCER	14.00					
ABC	SOM MFD	28+50.00	102.96	28+50.00	101.53		DROP MANHOLE						
ABC	SOM MFD	28+50.00	101.53	32+65.00	101.18	66	CIRCULAR	415.00	0.000843	23.76	.015	84.60	54.68
ABC	SOM MFD	32+65.00	101.18	33+85.00	101.09	66	SIPHON	120.00	0.000750	23.76	.015	41.80	27.01
ABC	SOM MFD	33+85.00	101.09	53+40.00	98.99	66	CIRCULAR	1955.00	0.001074	23.76	.015	95.59	61.78
ABC	SOM MFD	53+40.00	98.99	55+73.00	99.22	66	SIPHON	233.00		23.76	.015	56.38	35.44
ABC	SOM MFD	55+73.00	99.22	81+88.00	96.63	66	CIRCULAR	2615.00	0.000990	23.76	.015	91.78	59.32
ABC	SOM MFD	81+88.00	96.63	109+10.00	93.96	66	CIRCULAR	2722.00	0.000981	23.76	.015	91.36	59.04
ABC	SOM MFD	109+10.00	93.96	110+80.00	93.96		PUMP STATION	170.00					
ABC	SOM MFD	110+80.00	93.96	117+50.00	102.50	66FM	CIRCULAR	670.00		23.75	.015		
ABC	SOM MFD	117+50.00	102.50	131+25.00	102.10	66	CIRCULAR	1375.00	0.000291	23.76	.015	49.76	32.16
ABC	SOM MFD	131+25.00	102.10	131+35.00	102.10	60	CIRCULAR	10.00		19.64	.015		

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
ABC	SOM MFD	131+35.00	102.10	133+40.00	101.75	60	SIPHON	205.00	0.001707	19.64	.015	57.49	37.15
ABC	SOM MFD	133+40.00	101.75	141+75.00	100.61	66	CIRCULAR	835.00	0.001365	23.76	.015	107.70	69.60
ABC	BLM CAM	200+87.00	106.76	202+28.00	106.61	36	SIPHON	141.00	0.001063	7.07	.015	17.72	11.45
ABC	BLM CAM	202+28.00	106.61	235+13.00	103.02	36	CIRCULAR	3285.00	0.001093	7.07	.015	19.12	12.36
RAVF	BLM CAM	0+00.00	106.20	3+25.00	105.26	48	CIRCULAR	325.00	0.002892	12.57	.015	67.08	43.35
RAVE	BLM CAM	3+25.00	105.26	3+25.00	100.00		DROP MANHOLE						
RAVF	BLM CAM	0+00.00	101.00	1+00.00	102.65	24	CIRCULAR	100.00	0.016500	3.14	.015	25.22	16.30
BSF	MAL	0+00.00	106.03	0+62.00	106.31	15	CIRCULAR	62.00	0.001290	1.23	.013	2.32	1.50
BSE	MAL	0+62.00	106.31	0+62.00	106.11		DROP MANHOLE						
BSE	MAL	0+62.00	106.11	17+29.00	109.65	15	CIRCULAR	1667.00	0.002004	1.23	.013	2.89	1.87
BSW	MAL	0+00.00	102.50	3+27.27	102.86	24	CIRCULAR	327.27	0.001100	3.14	.013	7.50	4.85
BSW	MAL	3+27.27	102.86	3+27.27	105.45		DROP MANHOLE						
BSW	MAL	3+27.27	105.45	7+88.81	106.11	18	CIRCULAR	461.54	0.001430	1.77	.013	3.97	2.57
A	ROX	11+52.00	96.51	37+01.22	97.24		SPECIAL	2549.22	0.000286	23.76		46.24	29.88
B	BOS BRO	0+00.00	97.24	29+61.22	98.43	66	CIRCULAR	2961.22	0.000400	23.76	.016	54.69	35.34
C	BOS BRI	0+00.00	98.44	40+05.50	100.04	58X63	GOTHIC	4005.50	0.000399	19.63	.016	42.41	27.41
C	BOS BRI	40+05.50	100.04	41+48.00	100.10	54X63	GOTHIC	142.50	0.000411	17.90	.016	37.92	24.51
C	BOS BRI	41+48.00	100.10	41+60.00	100.10		CHAMBER	12.00					
C	BOS BRI	41+60.00	100.10	41+75.00	100.11	54X63	GOTHIC	15.00	0.000400	17.90	.016	37.92	24.51
C	BOS BRI	41+75.00	100.11	43+43.00	100.18	58X63	GOTHIC	168.00	0.000416	19.63	.016	43.25	27.95
C	BOS BRI	43+43.00	100.18	45+84.60	100.27	54X63	GOTHIC	241.60	0.000372	17.90	.016	35.07	23.31
C	BOS BRI	45+84.60	100.27	46+11.60	100.28	58X63	GOTHIC	27.00	0.000370	19.63	.016	40.79	26.36

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
C	BOS BRI	46+11.60	100.28	47+34.00	100.33	54X63	GOTHIC	122.40	0.000408	17.90	.016	37.41	24.18
C	BOS BRI	47+34.00	100.33	50+82.08	100.47	58X63	GOTHIC	348.08	0.000402	19.63	.016	42.41	27.41
C	BOS BRI	50+82.08	100.47	58+13.29	100.72	84	CIRCULAR	731.21	0.000341	38.48	.016	96.07	62.09
C	BOS BRI	58+13.29	100.72	59+19.65	100.76	58X63	GOTHIC	106.36	0.000376	19.63	.016	41.12	26.57
D	BRI	0+00.00	100.76	7+45.00	101.06	58	CIRCULAR	745.00	0.000402	18.35	.016	38.67	24.99
D	BRI	7+45.00	101.06	7+85.00	101.07		TRANSITION	40.00	0.000250				
D	BRI	7+85.00	101.07	53+00.25	102.88	54X61.5	GOTHIC	4515.25	0.000400	18.38	.016	38.89	25.13
E	BOS	0+00.00	102.88	15+81.00	103.51	54X61.5	GOTHIC	1581.00	0.000398	18.38	.016	38.89	25.13
E	BOS	15+81.00	103.51	16+31.00	103.53	58	CIRCULAR	50.00	0.000400	18.35	.016	38.67	24.99
E	BOS	16+31.00	103.53	80+27.19	106.09	54X61.5	GOTHIC	6396.19	0.000400	18.38	.016	38.89	25.13
F	NEW WAT	0+00.00	106.09	57+08.00	108.37	50X57.5	GOTHIC	5708.00	0.000399	15.93	.016	32.02	20.69
F	NEW WAT	57+08.00	108.37	57+17.00	108.38		TRANSITION	9.00	0.001111				
F	NEW WAT	57+17.00	108.38	76+93.98	109.17	47X53	GOTHIC	1976.98	0.000399	13.83	.016	26.64	17.22
G	NEW	0+00.00	109.17	12+55.00	109.67	47X53	GOTHIC	1255.00	0.000398	13.83	.016	26.64	17.22
G	NEW	12+55.00	109.67	17+07.00	115.55	42X48	GOTHIC	452.00	0.013008	11.16	.016	113.90	73.61
G	NEW	17+07.00	115.55	28+00.00	116.27	42X48	GOTHIC	1093.00	0.000658	11.16	.016	25.61	16.55
H	NEW	28+00.00	116.27	57+15.00	118.20	42X48	GOTHIC	2915.00	0.000662	11.16	.016	25.79	16.67
H	NEW	57+15.00	118.20	57+35.00	118.24		TRANSITION	18.00	0.002222				
H	NEW	57+35.00	118.24	58+25.00	118.44	45X29	RECTANGULAR	90.00	0.002222	9.06	.016		
H	NEW	58+25.00	118.44	58+45.00	118.49		TRANSITION	20.00	0.002500				
H	NEW	58+45.00	118.49	58+65.00	118.56	42X48	GOTHIC	20.00	0.003500	11.16	.016	59.08	38.18
H	NEW	58+65.00	118.56	59+00.00	120.54	42X48	GOTHIC	35.00	0.056571	11.16	.016	237.50	153.49

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
H	NEW	59+00.00	120.54	72+84.00	121.47	42X48	GOTHIC	1384.00	0.000671	11.16	.016	25.87	16.72
5	BRO BOS	2+51.37	84.15	80+95.45	86.90	108	CIRCULAR	7880.08	4.967424	63.62	.016	190.20	122.92
1	BOS CAM	19+37.64	88.91	34+72.84	89.51	88X117.25	HORSESHOE	1535.18	0.000390	58.72	.016	182.90	118.20
1	BOS CAM	34+72.84	89.51	42+48.50	92.61	2-60	SIPHON	775.66		39.28	.01		
1	BOS CAM	42+48.50	92.61	86+08.12	94.57	84X112	HORSESHOE	4523.00	0.000449	53.53	.016	171.60	110.90
1	BOS CAM	86+08.12	94.57	86+08.12	94.82		DROP MANHOLE						
1	BOS CAM	86+08.12	94.82	105+99.95	95.62	81X108	HORSESHOE	1991.84	0.000401	49.78	.016	145.50	94.68
2	BOS	106+00.00	95.62	151+23.00	97.43	81X108	HORSESHOE	4523.00	0.000400	49.78	.016	146.50	94.68
2	BOS	151+23.00	97.43	151+23.00	97.85		DROP MANHOLE						
2	BOS	151+23.00	97.85	164+36.00	98.70	76X101.25	HORSESHOE	1313.00	0.000647	43.80	.016	157.30	101.66
3	WAT BOS	164+36.00	98.70	255+78.00	104.19	72	CIRCULAR	9142.00	0.000600	28.27	.015	90.11	58.24
3	WAT BOS	255+78.00	104.19	255+78.00	105.18		DROP MANHOLE						
3	WAT BOS	255+78.00	105.18	258+36.00	105.44	60	CIRCULAR	258.00	0.001007	19.64	.015	71.53	45.23
4	WAT NEW	258+27.00	105.44	336+44.00	113.25	60	CIRCULAR	7817.00	0.000999	19.64	.015	71.50	46.21
4	WAT NEW	336+44.00	113.25	336+44.00	114.75		DROP MANHOLE						
4	WAT NEW	336+44.00	114.75	352+03.00	116.30	42	CIRCULAR	1559.00	0.000994	9.62	.015	27.54	17.80
4A	WAL	352+03.00	116.30	39+40.00	120.39	42	CIRCULAR	3837.00	0.001065	9.62	.015	28.51	18.43
4A	WAL	390+40.00	120.39	401+78.00	123.24	36	CIRCULAR	1138.01	0.002506	7.07	.015	28.99	18.74
4A	WAL	401+78.00	123.24	403+86.63	123.76	30	CIRCULAR	208.63	0.002506	4.91	.015	17.83	11.52
4A	WAL	403+86.63	123.76	441+64.00	133.21	36	CIRCULAR	3777.36	0.002506	7.07	.015	23.99	18.74
9	DOR	128+13.37	105.98	128+31.32	106.24	54	CIRCULAR	17.95	0.014484	15.90	.016	192.70	124.54
9	DOR	128+31.32	106.24	163+95.27	108.01	36X48	EGG	3563.95	0.000496	9.34	.016	17.62	11.39

TABLE A-1 MDC INTERCEPTORS NORTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
10	DOR	163+95.27	108.00	179+89.95	108.80	36X48	EGG	1594.68	0.000501	9.34	.016	17.08	11.04
11	DOR	179+89.95	108.80	180+10.00	108.81	36X48	EGG	20.04	0.000499	9.34	.016	17.62	11.39
11	DOR	180+10.00	108.81	189+55.00	115.98	28X42	EGG	945.00	0.007587	6.48	.016	42.03	27.16
11	DOR	189+55.00	115.98	193+81.81	117.54	28X42	EGG	426.97	0.003653	6.48	.016	29.16	18.85
12	DOR	0+00.00	117.56	0+10.00	120.02	28X42	EGG	10.00	0.246000	6.48	.016	239.30	154.65
12	DOR	0+10.00	120.02	9+85.09	121.00	36X37	EXT. CIRCLE	975.09	0.001005	7.32	.016	17.94	11.59
13	DOR	0+00.00	121.00	38+00.00	124.80	36X37.75	EXT. CIRCLE	3800.00	0.001000	7.51	.016	18.58	12.01
14	DOR	0+00.00	124.80	16+89.00	126.69	36X37.50	EXT. CIRCLE	1689.00	0.001119	7.44	.016	19.48	12.59
14	DOR	16+89.00	126.69	19+28.50	126.93	30X31.5	EXT. CIRCLE	239.50	0.001002	5.22	.016	11.48	7.42
14	MTN CON	0+00.00	126.37	1+92.00	126.62	20	CIRCULAR	192.00	0.001300	2.18	.016	4.10	2.65
15	DOR HP	0+00.00	126.93	14+47.00	128.38	30X31.5	EXT. CIRCLE	1447.00	0.001002	5.22	.016	11.48	7.42
15	DOR HP	17+80.00	127.95	14+65.00	128.40	54X55.75	EXT. CIRCLE	315.00	0.001428	16.56	.016	53.79	41.23

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
15	DOR HP	17+95.00	128.73	24+70.30	129.40	54X55.75	EXT. CIRCLE	675.30	0.000992	16.56	.016	53.17	34.36
16	HP	0+00.00	129.40	17+10.00	131.11	54X55.5	EXT. CIRCLE	1710.00	0.001000	16.47	.016	53.07	34.30
16	HP	17+10.00	131.11	17+18.00	131.21		TRANSITION	8.00	0.001000				
16	HP	17+18.00	131.21	23+79.29	131.88	51X52.5	EXT. CIRCLE	661.29	0.001013	14.72	.016	45.99	29.72
17	HP	0+00.00	131.86	17+68.72	133.63	51.5X52.5	EXT. CIRCLE	1768.72	0.001000	14.82	.016	45.97	29.71
18	HP	0+00.00	133.63	27+19.35	136.35	51X52.75	EXT. CIRCLE	2719.35	0.001000	14.81	.016	45.97	29.71
19	HP	0+00.00	136.35	12+90.00	137.74	51X52.75	EXT. CIRCLE	1290.00	0.001077	14.81	.016	47.71	30.83
19	HP	12+90.00	137.74	26+50.96	139.10	48X49.75	EXT. CIRCLE	1360.96	0.000999	13.15	.016	39.24	25.36
20	HP	0+00.00	139.10	30+57.70	142.15	48X49.75	EXT. CIRCLE	3057.70	0.000997	13.15	.016	39.24	25.36
20	HP	30+57.70	142.15	30+57.70	144.51		DROP MANHOLE						
20	HP	30+57.70	144.51	32+12.59	144.66	48X49.75	EXT. CIRCLE	154.89	0.000968	13.15	.016	38.61	24.95
21	HP DED	0+00.00	144.66	0+80.00	144.81	48X50	EXT. CIRCLE	80.00	0.001875	13.23	.016	54.09	34.96
21	HP DED	0+80.00	144.81	1+60.00	144.98	48X50	EXT. CIRCLE	80.00	0.002125	13.23	.016	57.58	37.21
21	HP DED	1+60.00	144.98	35+98.62	148.42	48X50	EXT. CIRCLE	3438.62	0.001000	13.23	.016	39.50	25.53
22	DED	0+00.00	148.42	10+48.00	154.50	48X49.5	EXT. CIRCLE	1048.00	0.005801	13.07	.016	93.91	60.69
22	DED	10+48.00	154.50	10+48.00	159.50		DROP MANHOLE						
22	DED	10+48.00	159.50	13+29.18	159.77	48X49.5	EXT. CIRCLE	281.18	0.000960	13.07	.016	38.20	24.69
22	DED	13+29.18	159.77	13+29.18	164.45		DROP MANHOLE						
22	DED	13+29.18	164.45	24+03.71	165.50	48X49.5	EXT. CIRCLE	1074.53	0.000977	13.07	.016	38.54	24.91
23	DED	0+00.00	165.50	0+90.00	165.60	48X49.5	EXT. CIRCLE	90.00	0.001111	13.07	.016	41.10	26.56
23	DED	0+90.00	165.60	0+90.00	168.60		DROP MANHOLE						
23	DED	0+90.00	168.60	8+00.00	169.29	48X49.5	EXT. CIRCLE	710.00	0.000971	13.07	.016	38.42	24.83

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
23	DED	8+00.00	169.29	8+00.00	172.75		DROP MANHOLE						
23	DED	8+00.00	172.75	25+95.98	173.94	48X49.5	EXT. CIRCLE	1795.98	0.000662	13.07	.016	31.84	20.58
24	DED	0+00.00	173.94	0+78.00	173.99	48X49.5	EXT. CIRCLE	78.00	0.000641	13.07	.016	31.21	20.17
24	DED	0+78.00	173.99	0+84.00	174.09		TRANSITION	6.00	0.016666				
24	DED	0+84.00	174.09	24+66.15	175.68	45X46.5	EXT. CIRCLE	2382.15	0.000667	11.51	.015	26.90	17.38
25	DED	0+00.00	175.68	4+75.00	176.00	45X46	EXT. CIRCLE	475.00	0.000674	11.36	.016	26.48	17.11
25	DED	4+75.00	176.00	26+65.94	177.10	45X46	EXT. CIRCLE	2190.94	0.000502	11.36	.016	22.81	14.74
26	DED WRO	0+00.00	177.10	8+57.00	177.53	45X46.5	EXT. CIRCLE	857.00	0.000501	11.51	.016	24.11	15.58
26	DED WRO	8+57.00	177.53	13+08.80	177.75	45X48	EXT. CIRCLE	451.80	0.000486	11.98	.016	24.26	15.68
26	DED WRO	13+08.80	177.75	22+08.00	178.40	45X48.5	EXT. CIRCLE	899.20	0.000722	12.14	.016	29.98	19.38
26	DED WRO	22+08.00	178.40	22+13.00	178.39		TRANSITION	5.00					
26	DED WRO	22+13.00	178.39	22+39.00	178.22	45X46.75	EXT. CIRCLE	26.00		11.59	.016		
26	DED WRO	22+39.00	178.22	22+39.00	178.59		DROP MANHOLE						
26	DED WRO	22+39.00	178.59	22+52.00	178.59		TRANSITION	13.00					
26	DED WRO	22+52.00	178.59	28+35.00	179.15	34X36	EXT. CIRCLE	583.00	0.000960	6.78	.016	15.94	10.30
26	DED WRO	28+35.00	179.15	40+70.20	180.33	34X35.5	EXT. CIRCLE	1235.20	0.000955	6.66	.016	15.43	9.97
27	WRO	0+00.00	180.33	10+50.00	181.33	34X36	EXT. CIRCLE	1050.00	0.000952	6.78	.016	15.86	10.25
27	WRO	10+50.00	181.33	22+90.00	182.73	34X39	EXT. CIRCLE	1240.00	0.001129	7.49	.016	19.74	12.76
27	WRO	22+90.00	182.73	26+15.00	182.81	34X35	EXT. CIRCLE	325.00	0.000246	6.54	.016	7.70	4.98
27	WRO	26+15.00	182.81	32+70.00	183.44	34X37	EXT. CIRCLE	655.00	0.000961	7.01	.015	16.68	10.78
27	WRO	32+70.00	183.44	34+45.00	183.43	34X35.5	EXT. CIRCLE	175.00		6.66	.016		
27	WRO	34+45.00	183.43	34+57.70	183.44		TRANSITION	12.70	0.000787				

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPF	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
28	WRO	0+00.00	183.44	0+10.00	183.70		TRANSITION	10.00	0.026000				
28	WRO	0+10.00	183.70	33+33.21	186.88	32X32.75	EXT. CIRCLE	3323.21	0.000956	5.75	.016	12.76	8.25
28	WRO	33+33.21	186.88	33+33.21	189.51		DROP MANHOLE						
28	WRO	33+33.21	189.51	45+67.02	191.32	26X26.75	EXT. CIRCLE	1233.81	0.001467	3.82	.016	9.20	5.95
29	WRO	0+00.00	191.32	4+48.51	191.99	26X26.25	EXT. CIRCLE	448.51	0.001493	3.73	.016	8.97	5.80
29	WRO	4+48.51	191.99	4+48.51	191.99		DROP MANHOLE						
29	WRO	4+48.51	196.49	24+01.51	200.00	20	CIRCULAR	1953.00	0.001797	2.18	.015	5.15	3.33
29	WRO	24+01.51	200.00	24+01.51	200.55		DROP MANHOLE						
29	WRO	24+01.51	200.55	37+54.96	203.24	15	CIRCULAR	1353.45	0.002024	1.23	.015	2.52	1.63
29	WRO	37+54.96	203.24	45+57.88	210.02	15	CIRCULAR	802.92	0.008444	1.23	.015	5.15	3.33
29	WRO	45+57.88	210.02	47+13.12	216.82	12	CIRCULAR	155.24	0.043803	.79	.015	6.47	4.18
30	WRO NEW	0+00.00	192.20	23+55.99	197.89	24	CIRCULAR	2355.99	0.002415	3.14	.015	9.65	6.24
30	WRO NEW	23+55.99	197.89	23+55.99	198.64		DROP MANHOLE						
30	WRO NEW	23+55.99	198.64	34+82.25	221.17	15	CIRCULAR	1126.26	0.020004	1.23	.015	7.93	5.12
30	WRO NEW	34+82.25	221.17	46+25.41	224.03	18	CIRCULAR	1143.16	0.002501	1.77	.015	4.56	2.95
30	WRO NEW	46+25.41	224.03	46+25.41	224.28		DROP MANHOLE						
30	WRO NEW	46+25.41	224.28	52+09.79	235.98	15	CIRCULAR	584.38	0.020021	1.23	.015	7.93	5.12
30	WRO NEW	52+09.79	235.98	67+18.00	239.76	18	CIRCULAR	1508.21	0.002506	1.77	.015	4.56	2.95
31	MTN HP	0+00.00	133.09	1+60.00	133.24	54X60	EXT. CIRCLE	160.00	0.000938	18.15	.016	58.57	37.85
31	MTN HP	1+60.00	133.24	3+04.00	134.20	2-30	SIPHON	144.00	0.006666	9.82	.016	41.47	26.80
31	MTN HP	3+04.00	134.20	3+13.00	134.20	54X60	EXT. CIRCLE	9.00		18.15	.016		
32	CAN DED	0+00.00	137.14	15+82.00	140.47	18	CIRCULAR	1582.00	0.002105	1.77	.015	4.25	2.75

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
32	CAN DED	15+82.00	140.47	16+88.00	141.47	2-12	SIPHON	106.00	0.009434	1.57	.015	5.17	3.34
32	CAN DED	16+88.00	141.47	22+47.00	143.00	18	CIRCULAR	559.00	0.002737	1.77	.015	4.77	3.08
43	QUI	0+12.00	109.86	14+12.00	74.50		TREAT. PLANT	1400.00					
44	QUI	0+00.00	109.86	12+68.27	110.21		NI CHANGES	1268.27					
45	QUI	0+00.00	110.21	9+68.00	110.49	135X150	HORSESHOE	968.00	0.000289	116.68	.014	441.40	285.27
46	QUI	0+00.00	110.49	7+91.07	110.68	135X150	HORSESHOE	791.07	0.000240	116.68	.014	402.70	260.26
47	QUI	0+00.00	110.68	31+61.82	111.55	135X150	HORSESHOE	3161.82	0.000275	116.68	.014	434.40	280.74
48	QUI	0+00.00	111.55	58+80.58	113.17	135X150	HORSESHOE	5880.58	0.000275	116.68	.014	434.40	280.74
49	QUI	0+00.00	113.17	34+94.21	114.13	135X150	HORSESHOE	3494.21	0.000274	116.68	.014	432.10	279.26
50	QUI	0+00.00	114.13	0+18.00	114.14	135X150	HORSESHOE	18.00	0.000555	116.68	.014	614.90	397.40
50	QUI	0+18.00	114.14	0+38.00	114.14		TRANSITION	20.00					
50	QUI	0+38.00	114.14	2+10.00	114.19	135X102	HORSESHOE	172.00	0.000290	81.99	.014	277.80	179.54
50	QUI	2+10.00	114.19	2+30.00	114.19		TRANSITION	20.00					
50	QUI	2+30.00	114.19	30+71.38	114.98	135X150	HORSESHOE	2841.38	0.000278	116.68	.014	434.40	280.74
51	QUI	0+00.00	114.98	23+66.00	115.65	135X150	HORSESHOE	2366.00	0.000283	116.68	.014	441.40	285.27
52	QUI	0+00.00	115.65	27+74.43	116.41	132X147	HORSESHOE	2774.43	0.000273	111.83	.014	407.20	263.16
53	QUI	0+00.00	116.41	19+00.00	116.93	132X147	HORSESHOE	1900.00	0.000273	111.83	.014	412.50	266.59
54	QUI	0+00.00	116.93	19+89.81	117.48	132X147	HORSESHOE	1989.81	0.000276	111.83	.014	412.50	266.59
55	QUI MTN	0+00.00	117.48	30+00.00	118.31	132X144	HORSESHOE	3000.00	0.000276	109.59	.014	397.10	256.64
55	QUI MTN	30+00.00	118.31	30+14.00	118.31		TRANSITION	14.00					
55	QUI MTN	30+14.00	118.31	35+56.63	118.46	127X139	HORSESHOE	542.63	0.000276	102.22	.014	362.20	234.08
56	MTN	0+00.00	118.46	14+99.78	118.87	127X139	HORSESHOE	1499.78	0.000273	102.22	.014	366.10	236.60

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
57	MTN	0+00.00	118.87	18+68.79	119.39	127X139	HORSESHOE	1868.79	0.000278	102.22	.014	366.10	236.60
58	MTN	0+00.00	119.39	14+22.00	119.79	127X139	HORSESHOE	1422.00	0.000281	102.22	.014	368.17	237.94
58	MTN	14+22.00	119.79	14+32.00	119.79		TRANSITION	10.00					
58	MTN	14+32.00	119.79	14+46.00	119.79	127X105.5	HORSESHOE	14.00		69.90	.014		
58	MTN	14+46.00	119.79	14+56.00	119.80		TRANSITION	10.00	0.001000				
58	MTN	14+56.00	119.80	25+59.68	120.12	127X139	HORSESHOE	1103.68	0.000290	102.22	.014	372.67	240.90
59	MTN	0+00.00	120.12	25+67.57	120.84	127X139	HORSESHOE	2567.57	0.000280	102.22	.014	366.10	236.60
60	MTN	0+00.00	120.84	16+09.79	121.28	127X139	HORSESHOE	1609.79	0.000273	102.22	.014	366.10	236.60
61	MTN	0+00.00	121.28	27+90.00	122.08	127X139	HORSESHOE	2790.00	0.000286	102.22	.014	370.00	239.12
61	MTN	27+90.00	122.08	27+94.00	122.08		TRANSITION	4.00					
61	MTN	27+94.00	122.08	28+15.00	122.09	127X127	HORSESHOE	21.00	0.000476	94.89	.014	433.00	279.84
61	MTN	28+15.00	122.09	28+19.00	122.09		TRANSITION	4.00					
61	MTN	28+19.00	122.09	28+26.97	122.09	127X139	HORSESHOE	7.97	0.000282	102.22	.014	370.00	239.12
62	MTN	0+00.00	122.09	21+73.39	122.69	127X139	HORSESHOE	2173.39	0.000276	102.22	.014	364.20	235.37
63	MTN	0+00.00	122.69	22+62.47	123.33	127X139	HORSESHOE	2262.47	0.000282	102.22	.014	370.00	239.12
64	HP MTN	0+00.00	123.29	0+52.12	123.33	127X139	HORSESHOE	52.12	0.000767	102.22	.014	606.20	391.77
64	HP MTN	0+52.12	123.33	2+10.00	123.78	3-60.5	SIPHON	157.88		59.86	.014	215.45	139.27
64	HP MTN	2+10.00	123.78	2+71.75	123.80	127X139	HORSESHOE	61.75	0.000323	102.22	.014	393.80	254.50
65	HP	0+00.00	123.80	6+45.50	123.98	127X139	HORSESHOE	645.50	0.000278	102.22	.014	364.20	235.37
65	HP	6+45.50	123.98	9+00.00	124.05	111X122	HORSESHOE	254.50	0.000275	77.88	.014	253.40	163.77
65	NEP VAL	6+10.82	123.97			54X55.75	EXT. CIRCLE			16.56	.016		
66	HP	0+00.00	124.05	53+00.00	125.54	111X122	HORSESHOE	5300.00	0.000281	77.88	.014	255.70	165.25

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC		FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
67	HP		0+00.00	125.54	1+74.64	125.60	111X122	HORSESHOE	174.64	0.000343	77.88	.014	282.00	182.25
67	HP		1+74.64	125.60	2+64.96	125.84	2-84	CIRCULAR	90.32	0.002657	76.97	.014	314.70	203.38
67	HP		2+64.96	125.84	3+28.06	125.86	111X122	HORSESHOE	63.10	0.000316	77.88	.014	271.10	175.21
68	HP	WRO	0+00.00	125.86	17+55.00	126.66	111X122	HORSESHOE	1755.00	0.000455	77.88	.014	324.80	209.91
68	HP	WRO	17+55.00	126.66	22+64.00	126.81	105X116	HORSESHOE	509.00	0.000294	69.83	.014	225.70	145.87
68	HP	WRO	22+64.00	126.81	23+10.00	126.82		REDUCER	46.00	0.000217				
68	HP	WRO	23+10.00	126.82	27+38.00	126.64	105X111	HORSESHOE	428.00		66.22	.014		
69	WRO		0+00.00	126.64	5+04.00	126.78	105X111	HORSESHOE	504.00	0.000277	66.22	.014	203.90	131.78
69	WRO		5+04.00	126.78	5+54.00	126.80		TRANSITION	50.00	0.000400				
69	WRO		5+54.00	126.80	25+96.17	127.38	105X116	HORSESHOE	2042.17	0.000284	69.83	.014	222.60	143.86
70	WRO		0+00.00	127.38	10+94.67	127.60	105X116	HORSESHOE	1094.67	0.000200	69.83	.014	186.10	120.27
70	WRO	OS	10+94.67	127.60	11+83.00	127.60	2-48	CIRCULAR	88.33	0.000452	25.12	.014	52.93	34.21
70	WRO	OS	11+83.00	127.64	11+97.00	127.65		REDUCER	14.00	0.000714				
70	WRO	OS	11+97.00	127.65	12+10.50	127.66	2-36	CIRCULAR	13.50	0.000740	14.14	.014	31.65	20.45
70	WRO	OS	12+10.50	127.66	12+18.00	127.66		INCREASER	7.50					
70	WRO	OS	12+18.00	127.66	12+86.66	127.70	2-48	CIRCULAR	68.66	0.000582	25.13	.014	60.06	38.82
70	WRO	NS	10+94.67	127.60	10+96.67	127.60	105X62	RECTANGULAR	2.00	0.000500	34.11	.014	322.10	208.17
70	WRO	NS	10+96.67	127.60	11+02.67	127.60		TRANSITION	6.00					
70	WRO	NS	11+02.67	127.60	12+78.66	127.69	120X63	RECTANGULAR	175.99	0.000511	48.34	.014	322.10	208.17
70	WRO	NS	12+78.66	127.69	12+84.66	127.69		TRANSITION	6.00					
70	WRO	NS	12+84.66	127.69	12+86.66	127.70	105X62	RECTANGULAR	2.00	0.005000	34.11	.014	322.10	208.17
70	WRO		12+86.66	127.70	37+35.00	128.45	105X116	HORSESHOE	2448.34	0.000306	69.83	.014	230.20	148.77

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
71	WRO	0+00.00	128.45	20+64.65	129.04	105X116	HORSESHOE	2064.65	0.000285	69.83	.014	222.60	143.86
72	WRO	0+00.00	129.04	29+79.38	129.89	105X116	HORSESHOE	2979.38	0.000285	69.83	.014	222.60	143.86
72	WRO	29+79.38	129.89	29+86.38	129.89		TRANSITION	7.00					
72	WRO	29+86.38	129.89	29+92.63	129.89	105X91	HORSESHOE	6.25		57.44	.014	171.40	110.77
72	WRO	29+92.63	129.89	29+99.63	129.90		TRANSITION	7.00	0.001428				
72	WRO	29+99.63	129.90	30+10.46	129.90	105X116	HORSESHOE	10.83	0.000286	69.83	.014	222.60	143.86
73	WRO		129.83	0+00.00	129.84		REDUCER	20.20	0.000495				
73	WRO	0+00.00	129.84	47+74.87	131.38	108	CIRCULAR	4774.87	0.000322	63.62	.014	208.50	134.75
74	WRO ROX	0+00.00	131.25	9+63.00	131.48	99X110	HORSESHOE	963.00	0.000238	62.54	.014	175.00	113.10
74	WRO ROX	9+63.00	131.48	9+83.00	131.97		BELLMOUTH	20.00	0.024500				
74	WRO ROX	9+83.00	131.97	29+83.00	132.85	78X84	HORSESHOE	2000.00	0.000440	37.31	.014	118.60	76.65
75	ROX	0+00.00	132.85	30+52.00	134.07	78X84	HORSESHOE	3052.00	0.000399	37.31	.014	113.10	73.09
76	ROX	0+00.00	134.08	0+16.00	134.09	78X84	HORSESHOE	16.00	0.000625	37.31	.014	141.50	91.45
76	ROX	0+16.00	134.09	0+36.00	134.75		BELLMOUTH	20.00	0.033000				
76	ROX	0+36.00	134.75	14+41.00	102.90	48FM	CIRCULAR	1405.00		12.57			
76	ROX	0+36.00	134.75	16+81.28	102.90	48FM	CIRCULAR	1645.28		12.57			
78	ROX	0+00.00	95.42	6+18.00	95.78	78X84	HORSESHOE	618.00	0.000582	37.31	.014	136.60	88.28
78	ROX	6+18.00	95.78	6+29.00	95.79		BELLMOUTH	11.00	0.000909				
78	ROX	6+29.00	95.79	6+52.00	95.80	78X84	HORSESHOE	23.00	0.000434	37.31	.014	117.90	76.20
78	ROX	6+52.00	95.80	6+78.10	96.03		BELLMOUTH	26.10	0.008812				
80	WRO	0+00.00	132.00	4+46.00	132.15	84X84	HORSESHOE	446.00	0.000336	43.12	.016	110.60	71.48
80	WRO	4+46.00	132.15	29+18.60	132.97	84	CIRCULAR	2472.60	0.000331	38.48	.016	95.08	61.45

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
80	WRO	29+18.60	132.97	31+24.00	133.04	78X84	HORSESHOE	205.40	0.000340	37.31	.016	91.15	58.91
81	BRO	0+00.00	133.04	33+84.80	134.16	78X84	HORSESHOE	3384.80	0.000330	37.31	.016	91.15	58.91
82	BRO	0+00.00	134.22	30+19.00	135.47	78X84	HORSESHOE	3019.00	0.000414	37.31	.016	101.40	65.53
82	BRO	30+19.00	135.47	30+23.00	135.23		TRANSITION	4.00					
82	BRO	30+23.00	135.23	30+35.00	135.23	87X65	HORSESHOE	12.00		40.00	.016		
82	BRO	30+35.00	135.23	30+39.00	135.23		TRANSITION	4.00					
82	BRO	30+39.00	135.23	48+50.00	136.08	75X78	HORSESHOE	1811.00	0.000469	34.02	.016	95.92	61.99
83	BRO	0+00.00	136.08	11+17.60	136.45	69X72	HORSESHOE	1117.60	0.000331	30.88	.016	70.88	45.81
83	BRO	11+17.60	136.45	11+24.60	136.45		TRANSITION	87.00					
83	BRO	11+24.60	136.45	11+31.60	136.46	73X67	HORSESHOE	7.00	0.001428	31.68	.016	151.60	97.98
83	BRO	11+31.60	136.46	11+38.60	136.46		TRANSITION	7.00					
83	BRO	11+38.60	136.46	16+11.00	136.62	69X72	HORSESHOE	472.40	0.000338	30.88	.016	70.88	45.81
83	BRO	16+11.00	136.62	16+20.00	136.62		TRANSITION	89.00					
83	BRO	16+20.00	136.62	16+23.00	136.62	73X67	HORSESHOE	3.00		31.68	.016		
83	BRO	16+23.00	136.62	16+35.00	136.62		TRANSITION	12.00					
83	BRO	16+35.00	136.62	18+16.00	136.68	69X66	HORSESHOE	181.00	0.000331	29.10	.016	65.58	42.38
83	BRO	18+16.00	136.68	18+30.00	136.69		TRANSITION	14.00	0.000714				
83	BRO	18+30.00	136.69	18+52.00	136.70	66	CIRCULAR	22.00	0.000454	23.75	.016	58.26	37.65
83	BRO	18+52.00	136.70	18+58.00	136.70		TRANSITION	86.00					
83	BRO	18+58.00	136.70	24+64.00	136.90	69X72	HORSESHOE	606.00	0.000330	30.88	.016	70.88	45.81
84	BRI BRO	0+00.00	136.90	21+68.67	137.62	69X72	HORSESHOE	2168.67	0.000332	30.88	.016	70.88	45.81
85	BRI	0+00.00	137.62	63+49.79	139.74	69X72	HORSESHOE	6349.79	0.000333	30.88	.016	70.88	45.81

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
86	BRI	0+00.00	139.74	5+80.00	139.93	69X72	HORSESHOE	580.00	0.000327	30.88	.016	70.13	45.32
86	BRI	5+80.00	139.93	5+90.00	139.94		TRANSITION	10.00	0.001000				
86	BRI	5+90.00	139.94	17+27.00	140.89	72X48	HORSESHOE	1137.00	0.000835	38.14	.016	148.50	95.97
86	BRI	17+27.00	140.89	17+37.00	140.90		TRANSITION	10.00	0.001000				
86	BRI	17+37.00	140.90	24+39.00	141.13	69X72	HORSESHOE	702.00	0.000327	30.88	.016	70.13	45.32
87	BRI NEW	0+00.00	141.13	19+60.00	142.28	63X66	EXT. CIRCLE	1960.00	0.000586	22.96	.016	63.40	40.97
98	WRO DED	0+00.00	178.21	0+00.00	179.98		DROP MANHOLE						
98	WRO DED	0+00.00	179.98	0+09.19	179.98		BELLMOUTH	9.19					
98	WRO DED	0+09.19	179.98	6+00.00	180.33	36X40	EXT. CIRCLE	590.81	0.000592	8.07	.015	16.82	10.87
98	WRO DED	6+00.00	180.33	6+20.00	180.34		TRANSITION	20.00	0.000500				
98	WRO DED	6+20.00	180.34	8+34.00	180.47	36X42	EXT. CIRCLE	214.00	0.000970	8.57	.015	23.60	15.25
98	WRO DED	8+34.00	180.47	8+45.00	180.48		TRANSITION	11.00	0.000909				
98	WRO DED	8+45.00	180.48	11+42.00	180.66	36X40	EXT. CIRCLE	297.00	0.000606	8.07	.015	17.07	11.03
98	WRO DED	11+42.00	180.66	11+57.00	180.67		TRANSITION	15.00	0.000666				
98	WRO DED	11+57.00	180.67	20+00.00	181.03	36X42	EXT. CIRCLE	843.00	0.000427	8.57	.015	15.43	9.97
98	WRO DED	20+00.00	181.03	20+30.00	181.43	36X42	EXT. CIRCLE	30.00	0.013333	8.57	.015	86.23	55.73
98	WRO DED	20+30.00	181.43	20+70.00	181.45	36X42	EXT. CIRCLE	40.00	0.000500	8.57	.015	16.70	10.79
98	WRO DED	20+70.00	181.45	20+81.00	181.70		TRANSITION	11.00	0.022727				
98	WRO DED	20+81.00	181.70	33+50.00	182.45	34X39	EXT. CIRCLE	1269.00	0.000591	7.49	.015	15.19	9.82
99	DED	0+00.00	182.45	0+12.50	182.46		TRANSITION	12.50	0.000800				
99	DED	0+12.50	182.46	25+34.11	183.94	33X36	EXT. CIRCLE	2521.60	0.000586	6.63	.015	12.83	8.29
99	DED	25+34.11	183.94	26+56.07	184.06	30	CIRCULAR	121.96	0.000983	4.91	.015	11.16	7.21

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
99	DED	26+56.07	184.06	32+99.05	184.43	33X36	EXT. CIRCLE	642.98	0.000575	6.63	.015	12.68	8.19
100	DED	0+00.00	184.43	39+21.05	186.72	33X36	EXT. CIRCLE	3921.05	0.000584	6.63	.015	12.83	8.29
101	DED NED	0+00.00	186.72	36+21.00	188.85	33X36	EXT. CIRCLE	3621.00	0.000588	6.63	.015	12.83	8.29
101	DED NED	36+21.00	188.85	37+79.00	189.80	2-16	SIPHON	158.00	0.006012	2.79	.015	8.88	5.74
101	DED NED	37+79.00	189.80	38+40.14	189.84	27X30	EXT. CIRCLE	61.14	0.000654	4.54	.015	8.16	5.27
102	NED	0+00.00	189.85	68+45.83	194.12	27X30	EXT. CIRCLE	6845.83	0.000623	4.54	.015	7.98	5.16
102	NED	68+45.83	194.12	68+50.16	194.12		TRANSITION	4.33					
102	NED	68+50.16	194.12	68+50.68	194.12	24X27	EXT. CIRCLE	.52		3.64	.015	5.95	3.85
103	NED	0+00.00	194.12	59+17.91	197.82	24X27	EXT. CIRCLE	5917.91	0.000625	3.64	.015	5.95	3.85
104	NED	0+00.00	197.82	13+29.00	198.65	24X27	EXT. CIRCLE	1329.00	0.000624	3.64	.015	5.95	3.85
104	NED	13+29.00	198.65	20+20.00	199.08	27X36	CATENARY	691.00	0.000622	5.31	.015	9.88	6.39
104	NED	20+20.00	199.08	27+20.00	199.52	24X27	EXT. CIRCLE	700.00	0.000628	3.64	.015	5.95	3.85
104	NED	27+20.00	199.52	30+34.00	199.71	27X36	CATENARY	314.00	0.000605	5.31	.015	9.72	6.28
104	NED	30+34.00	199.71	43+00.57	200.51	24X27	EXT. CIRCLE	1266.57	0.000631	3.64	.015	5.95	3.85
105	NED	0+00.00	200.51	44+25.20	203.28	24X27	EXT. CIRCLE	4425.20	0.000625	3.64	.015	5.95	3.85
106	NED WEL	0+00.00	203.28	43+55.00	206.00	24X27	EXT. CIRCLE	4355.00	0.000624	3.64	.015	5.95	3.85
107	MTN	0+00.00	127.10	35+68.33	128.53	72X75	EXT. CIRCLE	3568.33	0.000400	29.77	.016	73.99	47.82
108	MTN	0+00.00	128.53	37+78.80	130.04	72X75	EXT. CIRCLE	3778.80	0.000399	29.77	.016	73.99	47.82
109	MTN	0+00.00	130.04	44+50.54	131.82	72X75	EXT. CIRCLE	4450.54	0.000399	29.77	.016	73.99	47.82
110	MTN	0+00.00	131.82	31+70.00	133.09	72X75	EXT. CIRCLE	3170.00	0.000400	29.77	.016	73.99	47.82
110	MTN	31+70.00	133.09	31+77.00	133.09		BELLMOUTH	7.00		18.15			
110	MTN	31+77.00	133.09	31+80.48	133.09	54X60	EXT. CIRCLE	3.48		18.15	.016		

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	CAPACITY (MGD)
111	MTN CAN	0+00.00	133.09	56+00.79	134.96	54X60	EXT. CIRCLE	5600.79	0.000333	18.15	.016	34.95	22.59
112	CAN	0+00.00	134.96	55+99.50	136.86	54X60	EXT. CIRCLE	5599.50	0.000339	18.15	.016	34.95	22.59
113	CAN	0+00.00	136.86	12+58.00	137.28	54X60	EXT. CIRCLE	1258.00	0.000333	18.15	.C16	34.95	22.59
113	CAN	12+58.00	137.28	12+61.00	137.28		TRANSITION	3.00					
113	CAN	12+61.00	137.28	12+75.00	137.28	48	CIRCULAR	14.00		12.57	.016		
113	CAN	12+75.00	137.28	12+78.00	137.29		TRANSITION	3.00	0.003333				
113	CAN	12+78.00	137.29	46+47.00	138.41	54X60	EXT. CIRCLE	3369.00	0.000332	18.15	.016	34.95	22.59
113	CAN	46+47.00	138.41	46+52.30	138.41		TRANSITION	5.30					
113	CAN	46+52.30	138.41	46+65.70	138.41	48	CIRCULAR	13.40		12.57	.016		
113	CAN	46+65.70	138.41	46+71.00	138.42		TRANSITION	5.30	0.001886				
113	CAN	46+71.00	138.42	53+00.65	138.72	54X60	EXT. CIRCLE	629.65	0.000476	18.15	.016	41.72	26.96
114	CAN	0+00.00	138.81	58+00.00	140.74	54X60	EXT. CIRCLE	5800.00	0.000332	18.15	.016	34.95	22.59
115	CAN	0+00.00	140.74	43+31.23	142.18	54X60	EXT. CIRCLE	4331.23	0.000332	18.15	.016	34.95	22.59
115	CAN	43+31.23	142.18	43+45.23	142.50		BELLMOUTH	14.00	0.022857				
115	CAN	43+45.23	142.50	60+49.50	143.64	33X36	EXT. CIRCLE	1704.27	0.000668	6.63	.016	12.93	8.36
116	CAN NOR	0+00.00	142.19	7+99.00	142.51	48X51	EXT. CIRCLE	799.00	0.000400	13.57	.016	25.97	16.78
116	CAN NOR	7+99.00	142.51	8+48.00	133.00	36	SIPHON	49.00		7.07	.016	25.03	16.18
116	CAN NOR	8+48.00	133.00	8+97.00	143.01	36	SIPHON	49.00		7.07	.016	25.03	16.18
116	CAN NOR	8+97.00	143.01	52+00.92	144.73	54	CIRCULAR	4303.92	0.000399	15.90	.016	32.02	20.69
117	NOR	0+00.00	144.73	15+31.00	145.34	54	CIRCULAR	1531.00	0.000398	15.90	.016	25.97	16.78
117	NOR	15+31.00	145.34	15+69.00	135.50	36	SIPHON	38.00		7.07	.016	27.76	17.94
117	NOR	15+69.00	135.50	16+08.00	145.90	36	SIPHON	39.00		7.07	.016	27.76	17.94

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
117	NOR	16+08.00	145.90	57+33.00	147.49	48X51	EXT. CIRCLE	4125.00	0.000385	13.57	.016	25.48	16.47
117	NOR	57+33.00	147.49	57+37.00	148.50		TRANSITION	4.00	0.002500				
118	NOR WLP	0+00.00	148.50	0+40.00	151.53	36X39	EXT. CIRCLE	40.00	0.075750	7.82	.016	171.60	110.90
118	NOR WLP	0+40.00	151.53	17+10.00	153.20	36X39	EXT. CIRCLE	1670.00	0.001000	7.82	.016	19.72	12.74
118	NOR WLP	17+10.00	153.20	17+40.00	156.68		TRANSITION	30.00	0.116000				
118	NOR WLP	17+40.00	156.68	20+29.00	157.00	30X33	EXT. CIRCLE	289.00	0.001107	5.53	.016	13.13	8.49
118	NOR WLP	20+29.00	157.00	20+48.00	158.45	30X33	EXT. CIRCLE	19.00	0.076315	5.53	.016	108.80	70.32
118	NOR WLP	20+48.00	158.45	45+06.00	161.34	30X33	EXT. CIRCLE	2458.00	0.001175	5.53	.016	13.50	8.72
118	NOR WLP	45+06.00	161.34	45+78.00	170.61	30X33	EXT. CIRCLE	72.00	0.128750	5.53	.016	141.30	91.32
118	NOR WLP	45+78.00	170.61	49+30.30	171.00	30X33	EXT. CIRCLE	352.30	0.001107	5.53	.016	13.13	8.49
119	CAN	0+00.00	143.64	32+16.07	145.78	33X36	EXT. CIRCLE	3216.07	0.000665	6.63	.016	12.93	8.36
119	CAN	32+16.07	145.78	32+64.31	145.98	30	CIRCULAR	48.24	0.004145	4.91	.016	21.48	13.88
119	CAN	32+64.31	145.98	35+70.00	157.73	24X27	EXT. CIRCLE	306.69	0.038312	3.64	.016	43.71	28.25
119	CAN	35+70.00	157.73	35+80.26	158.14	24X27	EXT. CIRCLE	10.26	0.039961	3.64	.016	44.64	28.85
120	CAN	0+00.00	158.14	12+07.00	162.17	27X36	EXT. CIRCLE	1207.00	0.003338	5.67	.016	23.44	15.15
120	CAN	12+07.00	162.17	22+04.80	176.43	27X36	EXT. CIRCLE	1997.80	0.007137	5.67	.016	34.29	22.16
120	CAN	22+04.80	176.43	33+02.00	181.90	27X36	EXT. CIRCLE	1097.20	0.004985	5.67	.016	28.66	18.52
121	CAN	0+00.00	181.90	12+90.00	188.34	27X36	EXT. CIRCLE	1290.00	0.004992	5.67	.016	28.70	18.55
121	CAN	12+90.00	198.34	12+90.00	189.69		DROP MANHOLE						
121	CAN	12+90.00	189.69	15+50.00	193.87	20	CIRCULAR	260.00	0.016076	2.18	.015	14.43	9.33
121	CAN	15+50.00	193.87	32+12.00	200.51	20	CIRCULAR	1662.00	0.003995	2.18	.015	7.68	4.96
121	CAN	32+12.00	200.51	54+47.00	206.89	20	CIRCULAR	2235.00	0.002854	2.18	.015	6.49	4.19

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
121	CAN STO	54+47.00	206.89	54+81.67	211.30	20	CIRCULAR	34.67	0.112777	2.18	.015	40.78	26.36
122	BRA WEY	0+00.00	95.05	28+53.00	96.83	60X63	EXT. CIRCLE	2853.00	0.000623	20.89	.016	57.66	37.26
122	BRA WEY	28+53.00	96.83	28+65.00	96.84		TRANSITION	12.00	0.000833				
122	BRA WEY	28+65.00	96.84	55+28.58	98.50	57X60	EXT. CIRCLE	2663.58	0.000623	18.91	.016	50.51	3[illegible].64
123	QUI WEY	0+00.00	98.50	5+64.00	89.00	48	SIPHON	564.00		12.57	.016	35.49	22.49
123	QUI WEY	5+64.00	89.00	6+78.00	59.00	48	SIPHON	114.00		12.57	.016	35.49	22.94
123	QUI WEY	6+78.00	59.00	11+09.00	59.00	48	SIPHON	431.00		12.57	.016	35.49	22.94
123	QUI WEY	11+09.00	59.00	16+26.00	100.00	48	SIPHON	517.00		12.57	.016	35.49	22.94
123	QUI WEY	16+26.00	100.00	16+35.00	100.00	57X60	EXT. CIRCLE	9.00		18.91	.016		
124	WEY	0+00.00	100.00	30+48.00	101.22	57X60	EXT. CIRCLE	3048.00	0.000400	18.91	.016	40.41	26.12
124	WEY	30+48.00	101.22	30+83.00	99.50	42	SIPHON	35.00		9.62	.016	25.31	16.36
125	BRA WEY	0+00.00	99.50	5+95.00	90.75	42	SIPHON	595.00		9.62	.016	25.31	16.36
125	BRA WEY	5+95.00	90.75	7+09.00	90.75	42	SIPHON	114.00		9.62	.016	25.31	16.36
125	BRA WEY	7+09.00	90.75	15+62.00	102.72	42	SIPHON	853.00		9.62	.016	25.31	16.36
125	BRA WEY	15+62.00	102.72	28+78.00	103.25	50	CIRCULAR	1316.00	0.000402	13.64	.015	27.88	18.02
125	BRA WEY	28+78.00	103.25	29+90.00	79.40	30	SIPHON	112.00			.015	12.80	8.27
125	BRA WEY	29+90.00	79.40	33+30.00	79.40	30	SIPHON	340.00		4.91	.015	12.80	8.27
125	BRA WEY	33+30.00	79.40	36+22.00	104.50	30	SIPHON	292.00		4.91	.015	12.80	8.27
126	BRA	0+00.00	103.42	53+28.82	107.53	48	CIRCULAR	5328.82	0.000771	12.57	.015	34.59	22.35
126	BRA	53+28.82	107.53	53+48.65	96.00	2-18	SIPHON	19.83		3.53	.015	35.39	22.88
126	BRA	53+48.65	96.00	53+81.73	96.00	27	SIPHON	33.08		3.98	.015	35.39	22.88
126	BRA	53+81.73	96.00	54+00.82	108.78	27	SIPHON	19.09		3.98	.015	35.39	22.88

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	CAPACITY (MGD)
126	BRA	54+00.82	108.78	57+67.87	109.06	48	CIRCULAR	367.05	0.000490	12.57	.015	27.61	17.84
126	BRA	57+67.87	109.06	61+66.84	109.37	48	CIRCULAR	398.53	0.000777	12.57	.015	34.59	22.35
126	BRA	61+66.84	109.37	61+76.84	109.38	30	CIRCULAR	10.00	0.001000	4.91	.015	11.26	7.28
126	BRA	61+76.84	109.38	64+61.84	116.42	30	CIRCULAR	263.84	0.026682	4.91	.015	58.18	37.60
127	BRA	0+00.00	116.40	0+73.00	117.48	30	CIRCULAR	73.00	0.014794	4.91	.015	43.32	28.00
127	BRA	0+73.00	117.48	9+03.05	132.68	27	CIRCULAR	830.05	0.018312	3.98	.015	36.39	23.52
127	BRA	9+03.05	132.68	30+48.00	140.52	36	CIRCULAR	2144.95	0.003655	7.07	.015	35.25	22.78
127	BRA	30+48.00	140.52	30+52.00	141.02		TRANSITION	4.00	0.125000				
127	BRA	30+52.00	141.02	51+06.00	163.83	30	CIRCULAR	2054.00	0.011105	4.91	.015	37.54	24.26
127	BRA	51+06.00	163.83	51+10.00	166.80		TRANSITION	4.00	0.742500				
127	BRA	51+10.00	166.80	67+50.00	168.86	42	CIRCULAR	1640.00	0.001256	9.62	.015	30.89	19.96
128	BRA	0+00.00	168.86	17+06.00	171.00	42	CIRCULAR	1706.00	0.001254	9.62	.015	30.89	19.96
128	BRA	17+06.00	171.00	17+20.00	166.00	2-24	SIPHON	14.00		6.28	.015	33.97	21.96
128	BRA	17+20.00	166.00	17+40.00	171.04	2-24	SIPHON	20.00		6.28	.015	33.97	21.96
128	BRA	17+40.00	171.04	17+56.80	172.06	2-24	SIPHON	16.80		6.28	.015	33.97	21.96
128	BRA	17+56.80	172.06	23+39.00	172.79	42	CIRCULAR	582.20	0.001253	9.62	.015	30.89	19.96
128	NRA	23+39.00	172.79	23+43.00	173.73		TRANSITION	4.00	0.235000				
128	BRA	23+43.00	173.73	32+90.00	188.61	30	CIRCULAR	947.00	0.015649	4.91	.015	44.55	28.79
128	BRA	32+90.00	188.61	55+70.85	191.57	42	CIRCULAR	2280.85	0.001297	9.62	.015	31.48	20.34
128A	BRA RAN	0+00.00	191.55	36+73.73	196.32	42	CIRCULAR	3673.73	0.001298	9.62	.015	31.48	20.34
128A	BRA RAN	36+73.73	196.32	84+30.00	200.06	42	CIRCULAR	4756.27	0.000786	9.62	.015	24.51	15.84
128A	BRA RAN	84+30.00	200.06	85+10.00	201.61	2-15	SIPHON	80.00		2.45	.015	12.31	7.96

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	CAPACITY (MGD)
128A	BRA RAN	85+10.00	201.61	85+21.00	198.26	33	CIRCULAR	11.00		5.94	.015		
129	DED NED	23+99.61	185.15	76+29.00	188.44	54	CIRCULAR	5229.39	0.000629	15.90	.013	49.27	31.84
129	DED NED	76+29.00	188.44	78+17.82	189.26	2-33	SIPHON	188.82		11.88	.013	49.63	32.08
129	DED NED	78+17.82	189.26	96+00.00	190.38	54	CIRCULAR	1782.18	0.000628	15.90	.013	49.27	31.84
129	DED NED	96+00.00	190.38	96+00.00	190.88		DROP MANHOLE						
130	NED DOV	0+00.00	190.88	73+18.50	195.46	48	CIRCULAR	7318.50	0.000625	12.57	.013	35.98	23.25
130	NED DOV	73+18.50	195.46	75+68.50	196.58	2-27	SIPHON	250.00		7.96	.013	33.20	21.46
130	NED DOV	75+68.50	196.58	85+43.50	197.19	48	CIRCULAR	975.00	0.000625	12.57	.013	35.98	23.25
130	NED DOV	85+43.50	197.19	87+40.50	198.09	2-27	SIPHON	197.00		7.96	.013	32.00	20.68
130	NED DOV	87+40.50	198.09	99+27.19	198.83	48	CIRCULAR	1186.69	0.000623	12.57	.013	35.98	23.25
131	WEL NED	0+00.00	198.83	89+14.00	204.40	48	CIRCULAR	8914.00	0.000624	12.57	.013	35.98	23.25
132	NAT	0+00.00	204.80	0+04.00	204.80		TRANSITION	4.00					
132	NAT	0+04.00	204.80	4+70.00	205.12	48	CIRCULAR	466.00	0.000687	12.57	.013	37.78	24.42
132	NAT	4+70.00	205.12	5+87.00	205.92	2-27	SIPHON	117.00		7.96	.013	34.51	22.31
132	NAT	5+87.00	205.92	69+20.98	210.29	48	CIRCULAR	6333.98	0.000689	12.57	.013	37.78	24.42
132	NAT	69+20.98	210.29	71+45.98	211.53	2-27	SIPHON	225.00		7.96	.013	36.10	23.34
132	NAT	71+45.98	211.53	71+92.00	211.57	48	CIRCULAR	46.02	0.000869	12.57	.013	42.43	27.42
132	NAT	71+92.00	211.57	71+92.00	220.47		DROP MANHOLE						
132	NAT	71+92.00	220.47	79+82.00	221.00	48	CIRCULAR	790.00	0.000670	12.57	.013	37.29	24.10
132	NAT	79+82.00	221.00	79+82.00	224.72		DROP MANHOLE						
132	NAT	79+82.00	224.72	104+80.73	226.45	48	CIRCULAR	2498.73	0.000692	12.57	.013	37.86	24.47
133B	NAT	0+00.00	226.45	17+27.53	227.64	48	CIRCULAR	1727.53	0.000688	12.57	.013	37.78	24.42

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
133B	NAT	17+27.53	227.64	72+13.01	231.43	48X54	EXT. CIRCLE	5485.48	0.000690	14.57	.013	46.11	29.80
133B	NAT	72+13.01	231.43	96+24.71	232.74	48X54	EXT. CIRCLE	2411.70	0.000543	14.57	.013	40.95	26.47
133B	NAT	96+24.71	232.74	100+90.00	233.06	42	CIRCULAR	465.29	0.000687	9.62	.013	26.46	17.10
133B	NAT	100+90.00	233.06	130+87.56	235.13	48	CIRCULAR	2997.57	0.000690	12.57	.013	37.78	24.42
134	NAT FRM	30+00.00	235.13	43+34.00	236.01	48	CIRCULAR	1334.00	0.000659	12.57	.013	36.95	23.88
134	NAT FRM	43+34.00	236.01	43+34.00	236.51		DROP MANHOLE						
134	NAT FRM	43+34.00	236.51	48+20.00	236.81	42	CIRCULAR	486.00	0.000617	9.62	.013	25.04	16.18
134	NAT FRM	48+20.00	236.81	48+75.00	237.31	2-24	SIPHON	55.00		6.28	.013	24.15	15.61
134	NAT FRM	48+75.00	237.31	107+09.00	241.19	42	CIRCULAR	5834.00	0.000665	9.62	.013	25.94	16.76
134	NAT FRM	107+09.00	241.19	111+75.94	245.58	42	CIRCULAR	466.95	0.009400	9.62	.013	97.75	63.17
135	CAN NOR	0+00.00	140.18	1+37.67	140.26	36	CIRCULAR	137.67	0.000600	7.07	.015	13.96	9.02
135	CAN NOR	1+37.67	140.26	1+61.09	140.28	12.15.18	SIPHON	23.50		3.78	.015	15.94	10.30
135	CAN NOR	1+61.09	140.28	4+25.30	140.44	12.15.18	SIPHON	264.21		3.78	.015	15.94	10.30
135	CAN NOR	4+25.30	140.44	4+54.92	143.36	12.15.18	SIPHON	29.62		3.78	.015	15.94	10.30
135	CAN NOR	4+54.92	143.36	13+55.00	144.39	36	CIRCULAR	900.08	0.001144	7.07	.015	19.59	12.66
135	CAN NOR	13+55.00	144.39	56+00.00	147.79	30	CIRCULAR	3245.00	0.001047	4.91	.015	11.52	7.45
136	NOR	0+00.00	147.79	63+27.00	152.85	30	CIRCULAR	6327.00	0.000799	4.91	.015	10.07	6.51
136	NOR	63+27.00	152.85	63+27.00	153.35		DROP MANHOLE						
136	NOR	63+27.00	152.85	66+99.00	162.00	24	CIRCULAR	372.00	0.023520	3.14	.015	30.12	19.47
137A	WRO	0+00.00	129.00	16+00.00	130.31	84	CIRCULAR	1600.00	0.000818	38.48	.013	183.10	118.33
137	WRO	67+24.00	130.31	192+14.97	138.13	84	CIRCULAR	12490.97	0.000626	38.48	.013	160.00	103.40
137	WRO	192+14.97	138.13	192+14.97	174.40		DROP MANHOLE						

TABLE A-2 MDC INTERCEPTORS SOUTH SYSTEM

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	(MGD)
138	NED DED	192+14.97	174.44	201+83.00	175.04	84	CIRCULAR	968.02	0.000619	38.48	.013	160.00	103.40
138	NED DED	201+83.00	175.04	208+00.00	176.41	72	CIRCULAR	617.00	0.002220	28.27	.013	200.00	129.26
138	NED DED	208+00.00	176.41	324+00.50	185.15	60	CIRCULAR	11600.50	0.000753	19.64	.013	71.62	46.29

TABLE A-3. ABBREVIATIONS USED IN TABLES A-1 AND A-2

ABC	Alewife Brook Conduit	NED	Needham
ARL	Arlington	NEP VAL	Neponset Valley
BLM	Belmont	NEW	Newton
BOS	Boston	NOR	Norwood
BRA	Braintree	NS	New Section Over Old
BRI	Brighton	OS	Old Section
BRO	Brookline	QUI	Quincy
CAM	Cambridge	RAN	Randolph
CAN	Canton	REA	Reading
CHA	Charlestown	REV	Revere
CRC	Charles River Crossing	RAVE	Rindge Avenue
CHL	Chelsea	ROX	Roxbury
DED	Dedham	SOM	Somerville
DI	Deer Island	SHM	Stoneham
DOV	Dover	STO	Stoughton
DOR	Dorchester	WAK	Wakefield
EB	East Boston	WLP	Walpole
EVE	Everett	WAL	Waltham
FRA	Framingham	WAT	Watertown
HP	Hyde Park	WRO	West Roxbury
LEX	Lexington	WEL	Wellesley
MAL	Malden	WEY	Weymouth
MFD	Medford	WIL	Wilmington
MEL	Melrose	WIN	Winchester
MVS	Mystic Valley Sewer	WTP	Winthrop
MTN	Milton	WOB	Woburn
MTN CON	Milton Connection		
NAT	Natick		

APPENDIX B

INTERCEPTOR MODELING PACKAGES

APPENDIX B

INTERCEPTOR MODELING PACKAGES

For the purpose of computer modeling the MDC interceptor systems, all the interceptors are divided into 61 groups. These groups are arranged in such a way as to represent the system as it presently functions (1975). Each of these groups are called modeling packages. The North Metropolitan Sewerage System consists of 45 modeling packages and the South Metropolitan Sewerage System is divided into 16 modeling packages. Table B-1 lists the modeling packages and the interceptors that are included in each of these packages.

TABLE B-1. INDEX OF INTERCEPTOR MODELING PACKAGES

Model package No.	Interceptor names and section numbers included	System
N-1	North Metropolitan Sewer (Sections 2-9)	North
N-2	North Metropolitan Sewer (Sections 12, 14-20, 21 portion)	North
N-3	North Metropolitan Sewer (Section 21 portion)	North
	Alewife Brook Sewer (Sections 43-1/2, 43)	North
N-4	North Metropolitan Sewer (Sections 22 portion)	North
	Milbrook Valley Sewer (Sections 77-80 and 82-85)	North
N-5	North Metropolitan Sewer (Sections 22 portion, 44-1/2, 45-46)	North
N-6	North Metropolitan Relief Sewer (Sections 102-108)	North

TABLE B-1 (Continued). INDEX OF INTERCEPTOR MODELING PACKAGES

Model package No.	Interceptor names and section numbers included	System
N-7	North Metropolitan Relief Sewer (Sections 111-114, 115A, 115B)	North
N-8	New Mystic Valley Sewer (Sections 109-110, 67-70)	North
N-9	Reading Extension Sewer (Sections 71-76)	North
N-10	Wilmington Extension Sewer (Sections 88-90)	North
N-11	Mystic Valley Sewer	North
N-12	Cummingsville Branch Sewer (Section 47)	North
N-13	Cummingsville Branch Relief Sewer (Section 86)	North
N-14	Alewife Brook Conduit	North
N-15	Lexington Branch Sewer (Sections 52-53)	North
N-16	Milbrook Valley Relief Sewer (Sections 91A, 91B, 92-93)	North
N-17	Wakefield Branch Relief Sewer (Sections 87, 64, 58-60)	North
N-18	Wakefield Trunk Sewer (Section 40 portion)	North
	Malden Branch Relief Sewer (Section 95)	
N-19	Malden Branch Sewer (Sections 54-55)	North
N-20	Malden Branch Sewer (Sections 65-66)	North

TABLE B-1 (Continued). INDEX OF INTERCEPTOR MODELING PACKAGES

Model package No.	Interceptor names and section numbers included	System
N-21	Malden Branch Relief Sewer (Section 95A)	North
	Wakefield Trunk Sewer (Sections 40 portion and 41)	
	Stoneham Trunk Sewer (Section 42)	
N-22	Wakefield Branch Sewer (Sections 49-50)	North
N-23	Stoneham Extension Sewer (Section 51)	North
N-24	Chelsea Branch Sewer (Sections 11, 56-57)	North
N-25	Revere Branch Sewer (Sections 61-62)	North
N-26	Revere Branch Sewer (Section 57A)	North
N-27	South Charles Sewer (Sections A-H)	North
N-28	South Charles Relief Sewer (Sections 5, 1-4, and 4A)	North
N-29	North Charles Relief Sewer (Sections CRC, 204, 207A and 207B)	North
N-30	North Charles Metropolitan Sewer (Sections 29-30, 63)	North
N-31	North Charles Metropolitan Sewer (Section 209)	North
N-32	Cambridge Branch Sewer (Sections 23-25, 25-1/2, 26-28)	North

TABLE B-1 (Continued). INDEX OF INTERCEPTOR MODELING PACKAGES

Model package No.	Interceptor names and section numbers included	System
N-33	Charlestown Branch Sewer (Sections 31-32)	North
N-34	Somerville-Medford Branch Sewer (Section 35)	North
N-35	East Boston Branch Sewer (Sections 37-1/2, 37, 38 portion)	North
N-36	East Boston Branch Sewer (Section 38 portion)	North
N-37	East Boston Branch Sewer (Section 39)	North
N-38	Alewife Brook Conduit Belmont Branch	North
N-39	Belmont Branch Sewer (Section 81)	North
N-40	Bryant Street East Sewer, Malden	North
N-41	Bryant Street East Sewer, Malden	North
N-42	East Boston Interceptor (Section 38BR)	North
N-43	East Boston Interceptor (Section 39BR)	North
N-44	East Boston Interceptor (Section 36)	North
N-45	Dorchester Interceptor	North
	Neponset Valley Sewer (Sections 9-14, 15 portion)	

TABLE B-1 (Continued). INDEX OF INTERCEPTOR MODELING PACKAGES

Model package No.	Interceptor names and section numbers included	System
S-1	High Level Sewer (Sections 45-68)	South
S-2	High Level Sewer (Sections 69-75)	South
S-3	Brighton Branch Sewer (Sections 80-87)	South
S-4	Braintree-Weymouth Extension Sewer (Sections 122-125)	South
	Braintree-Randolph Extension Sewer (Sections 126-128)	South
S-5	Braintree-Randolph Extension Sewer (Sections 128-128A)	South
S-6	Braintree Connection (Section 125 BR)	South
S-7	New Neponset Valley Sewer (Sections 107-115)	South
	Stoughton Extension Sewer (Sections 119-121)	South
S-8	Hyde Park Connection (Section 31)	South
S-9	Dedham Connection (Section 32)	South
S-10	Westwood Extension Sewer (Sections 135-136)	South
S-11	Walpole Extension Sewer (Sections 116-118)	South
S-12	Upper Neponset Valley Sewer (Sections 15 portion, 16-29)	South

TABLE B-1 (Continued). INDEX OF INTERCEPTOR MODELING PACKAGES

Model package No.	Interceptor names and section numbers included	System
S-13	Upper Neponset Valley Sewer (Section 30)	South
S-14	Wellesley Extension Sewer (Section 98-106)	South
S-15	Wellesley Extension Relief Sewer (Sections 137A-131)	South
S-16	Framingham Extension Sewer (Sections 132-134)	South

These packages are on file at The Metropolitan District Commission.

APPENDIX C

INTERCEPTOR ANALYSIS PROGRAM INSTRUCTIONS

APPENDIX C

INTERCEPTOR ANALYSIS PROGRAM INSTRUCTIONS

This appendix presents the user instructions for the computer program used in modeling the MDC interceptor system. Described here is the Metcalf & Eddy PHP PROGRAM (as modified for MDC and called PHPA).

General

Name: PHPA. The program PHPA presented here is a modified version of Metcalf & Eddy Plant Hydraulics Profile Program (PHP). The original program was modified to remove sections not applicable for modeling the MDC interceptors.

Description. The program PHPA is designed to compute losses through hydraulic elements in sewers and treatment plants and thereby determine their hydraulic profile. PHPA consists of a SUPERVISOR PROGRAM, two main programs PHP0 and PHP1, and a number of subprograms. The SUPERVISOR PROGRAM determines whether to use PHP0 or PHP1 based on whether the flow is subcritical or supercritical. Each program identifies the type of element through which flow is currently passing and then calls appropriate subprograms to do the required computations. In this way, each main program, starting with an initial hydraulic grade line, calculates losses and flow properties through each successive element. PHP0 does all computations in a downstream to upstream sequence for subcritical flow and PHP1 performs all computations in an upstream to downstream sequence for supercritical flow. During computation the program checks the flow condition in each sewer section and identifies whether the flow is subcritical or supercritical.

Purpose. The program is used as a tool for the hydraulic analysis of water and wastewater treatment plants, sewer and interceptor networks, etc. It can be used to determine those pipes in an interceptor network that are inadequate to transport the peak design flows and to examine the conditions in a sewer system under alternative pipe replacement or relief strategies for remedial action.

Capabilities and Features. Program PHPA can be used to compute water surface profiles or hydraulic grade lines for a system consisting of any combination of the following elements:

1. Bar Screens (Five Types).

2. Bends (Pipes or conduits flowing full or part full).

3. Contractions and Expansions (Pipe, conduit or open channel).

4. Pipes, conduits, or open channel outfalls.

5. Pipe, conduit or open channel segments.

6. Unit operation (such as comminutors, pumps, flow measuring devices, etc.).

7. Grit chambers.

8. Chlorine chambers.

9. Siphons.

The program is independent of the sequence of the various elements listed above. In addition, the same element may occur in the flow path repeatedly. There are also many options available to the user. For details, please refer to the user instructions.

Restrictions and Limitations. This modified version of PHP is restricted in its use mostly to components encountered in the MDC interceptor system.

The program requires knowledge of the flow in each section in order to compute the hydraulic conditions of an interceptor system. Therefore, in the case of parallel pipes, the division of flow must be estimated initially and corrected by trial runs.

User Instructions

Program Processing. Program PHPA consists of a number of subroutines each of which is developed to do certain computations. For subcritical flow the flow profile computations usually start at an outfall and proceed upstream. However, the computation can be started at any place in a flow path where the water surface is known or can be computed. For supercritical flow the computations usually start at a critical section and proceed downstream. In general, every element in the flow path requires two data cards describing the properties of the particular element. For the inverted siphon, three data cards are required. In

some cases a third card may be required or used to read in downstream flow properties.

Logistics. Program PHPA will run on a machine as small as IBM 1130 with 8K storage.

Input Data Requirements. Input data requirements for program PHP are given in Table C-1. In general, two data cards are required for each element in the flow path. The program usually uses for downstream cross-sectional properties the upstream cross-sectional properties of the previous element in the flow path as these are the same when traveling from downstream to upstream direction. In some cases these two cross-sections are not the same, and, therefore, new cross-sectional properties for the downstream section are necessary. The program reads in new cross-sectional properties for the downstream section of the particular element when the user sets indicator KTYPE equal to any positive integer. A listing of a PHPA input data is presented in Table D-2 as an example.

Error Correction and Resubmission. If there are any errors in the computation they will be due to input data errors. Therefore, it is desirable to get a listing of the input data and check it thoroughly before submitting for a run.

Interpretation of Results. The results of the PHPA run are self-explanatory. Each particular output is identified clearly. An example of PHPA output is presented in Table D-3.

Documentation of Technical Concepts

Program PHPA consists of a number of subroutines each of which is developed to compute loss through a flow element. Theoretical basis of the loss computation in each case is presented here.

Theory. Bar Screen losses. The energy loss for flow through bar screens depends upon the shape, size, and spacing of the bars and the velocity of flow. Head loss h_{bar} can be expressed as:

$$h_{bar} = K\frac{V^2}{2g}$$

TABLE C-1. INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
A	1	I4	2-5	Project number		JOB	9999	None
	2	6A4	7-30	Project name		PRONA(I)		None
	3	5A2	31-40	User name		NAME(I)		None
	4	I1	80	Job type: sub-critical or super-critical flow. Use 1 for super-critical flow with computation moving downstream. Leave blank for subcritical flow or use 0		JOBTP		0
B	1	F10.4	1-10	Starting hydraulic grade line below outfall	ft.	HGL		None
	2	F10.4	11-20	Flow ratio: flow on data cards are multiplied by this ratio thus allowing the same data cards to be used for different flows		RATIO		1.00

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
B1	1	F10.4	1-10	Downstream hydraulic grade that may cause hydraulic jump. Omit card B1 if JOBTP equals 1 for supercritical flow.	ft.	DHGL		0.0
C	1	2A4	1-8	Identification of downstream location for subcritical flow and upstream location for supercritical flow.		FROM		None
	2	2A4	10-17	Identification of upstream location for subcritical flow and downstream location for supercritical flow.		TO		None
	3	5A4	19-38	Type of particular element to be printed in output.		TITLE		None
	4	I10	39-40	Index for downstream cross-section type; 1 for prismatic (rectangular, trapezoidal, etc.) 2 for circular.		ISCND*	2	None

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
C (cont)	5	I10	41-50	Index for upstream cross-section type; 1 for prismatic, 2 for circular		ISECN*	2	None
	6	I10	51-60	Index for element type. See explanation below.		ITYPE*	11	None
		ITYPE = 1		For bends				
		= 2		For pipe, conduit, channel, grit chambers, chlorine chambers				
		= 3		For contraction or expansion				
		= 4		Bar screen				
		= 5		Outfall				
		= 6		Unit operations				
		= 11		Inverted siphons				
	7	I10	61-70	Index for variation of element type; leave blank if ITYPE is 1,2,5, or 11		JTYPE*		0

When ITYPE = 3, JTYPE = 1 For contraction
= 2 For expansion

When ITYPE = 4, JTYPE = 1 For L/T = 5 rectangular bars
= 3 For L/T = 10 rectangular bars
= 2 For round bars
= 4 For $\frac{L}{T}$ = 10 with slightly rounded corners, rectangular bars

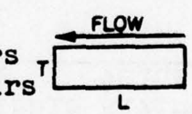


TABLE C-1 (Continued). INPUT DATA DESCRIPTION

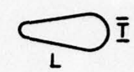
Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
			JTYPE = 5	For $\frac{L}{T}$ = 9.6 with tapered ends, rectangular bars				
			= 6	For $\frac{L}{T}$ = 5.0 with rounded and tapered edges				
C (cont)	8	I10	71-80	Indicator to read in downstream cross-sectional data and discharge. Leave blank if no data is to be read. Put any positive integer if data is to be read. KTYPE can have a positive value only if ITYPE ≤ 4.		KTYPE*		0
D (Omit if KTYPE (C8) is zero or ISCND (C4) is 2)						FOR ISCND = 1 (Prismatic section code)		
Cross-sectional properties at downstream end of prismatic sections.								
	1	F10.4	1-10	Invert elevation	ft.	ZO		None
	2	F10.4	11-20	Height of channel or conduit. If open channel, put 99.00	ft.	HT		None

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
	3	F10.4	21-30	Bottom width of channel or conduit.	ft.	B		None
	4	F10.4	31-40	Side slope of channel or conduit.		SS		0.0
	5	F10.2	41-50	Discharge in channel or conduit.	cfs.	Q		None
E (Omit if KTYPE (C8) is zero or ISCND (C4) is 1)						FOR ISCND = 2 (Circular section code)		
Cross-sectional properties at downstream end of circular sections.								
	1	F10.4	1-10	Invert elevation.	ft.	ZO		0.0
	2	F10.4	11-20	Diameter of pipe.	ft.	D		None
	3	F10.4	21-30	Discharge in pipe.	cfs.	Q		None
E1 card for ITYPE = 11; omit otherwise								
	1	I10	1-10	Number of inverted siphons in parallel.		NS*	6	1
	2	F10.2	11-20	Total discharge in all siphons	cfs.	Q		None
	3	F10.4	21-30	Total of siphon entrance and exit loss coefficients		CC		1.50

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
E2 card for ITYPE = 11; omit otherwise								
	1	F10.2	1-10	Total length of siphons	ft.	XL		None
	2	F10.4	11-20	Manning's n		XN		None
	3	F10.2	21-30	Diameter of first siphon	ft.	SD(1)		None
	4	F10.2	31-40	Diameter of second siphon	ft.	SD(2)		None
	5	F10.2	41-50	Diameter of third siphon	ft.	SD(3)		None
	6	F10.2	51-60	Diameter of fourth siphon	ft.	SD(4)		None
	7	F10.2	61-70	Diameter of fifth siphon	ft.	SD(5)		None
	8	F10.2	71-80	Diameter of sixth siphon	ft.	SD(6)		None

A maximum of six inverted siphons in parallel may be used. If all siphons are of same diameter, only the first diameter need be input. Program automatically assigns values to rest of the siphons.

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
E3 card for ITYPE = 2 and ISECN = 1 when JOBTP ≥ 1 For supercritical flow in conduits and channels; omit otherwise.								
	1	F10.4	1-10	Conduit or channel invert at upstream section	ft.	ZO		None
	2	F10.4	11-20	Conduit or channel height (use 99.0 for open channel)	ft.	HT		None
	3	F10.4	21-30	Bottom width	ft.	B		None
	4	F10.4	31-40	Side slope	ft/ft	SS		0.0
	5	F10.4	41-50	Discharge in conduit or channel	cfs.	Q		None
E4 card for ITYPE = 2 and ISECN = 2 when JOBTP ≥ 1 For supercritical flow in pipes; omit otherwise.								
	1	F10.4	1-10	Pipe invert at upstream section	ft.	ZO		None
	2	F10.4	11-20	Pipe diameter	ft.	D		None
	3	F10.4	21-30	Discharge in pipe	ft.	Q		None

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
F				Card F contains data for upstream section for the particular element in the flow path. Altogether there are seven types of elements that this program can handle. These seven types of F cards will now be explained				
F card when ITYPE = 1,3, or 5 and ISECN (C5) = 1; omit otherwise (bends, contractions and expansions, and outfalls) (Prismatic section)								
	1	F10.4	1-10	Channel invert	ft.	ZO		None
	2	F10.4	11-20	Height of channel (for open channel use 99.0)	ft.	HT		None
	3	F10.4	21-30	Bottom width of channel	ft.	B		None
	4	F10.4	31-40	Side slope of channel	ft.	SS		0.0
	5	F10.2	41-50	Discharge in channel	cfs.	Q		None

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
F (cont)	6	F10.4	51-60	Loss coefficient (leave blank if ITYPE = 5)		CB		1.10 for bend 1.00 for expansion 0.50 for contraction
F card when ITYPE (C6) = 1,3, or 5 and ISECN (C5) = 2; omit otherwise (bends, contractions and expansions, and outfalls) (Circular section)								
	1	F10.4	1-10	Pipe invert	ft.	ZO		0.0
	2	F10.4	11-20	Pipe diameter	ft.	D		None
	3	F10.4	21-30	Pipe discharge	cfs.	Q		None
	4	F10.4	31-40	Loss coefficient (leave blank if ITYPE = 5)		CB		1.10 for bend 1.00 for expansion 0.50 for contraction
F card when ITYPE (C6) = 2; omit otherwise (pipe, conduit, and channel)								
	1	F10.2	1-10	Length of pipe, conduit, or channel	ft.	XL		None
	2	F10.6	11-20	Slope	ft/ft.	SO		0.0
	3	F10.4	21-30	Manning's n to be used		XN		None

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
F (cont)	4	I10	31-40	Number of segments for computation and printout		NS*		None
F card when ITYPE = 4; omit otherwise (bar screen)								
	1	F10.4	1-10	Channel invert	ft.	ZO		None
	2	F10.4	11-20	Height of channel; for open channel use 99.0	ft.	HT		None
	3	F10.4	21-30	Bottom width	ft.	B		None
	4	F10.4	31-40	Side slope	ft/ft.	SS		0.0
	5	F10.4	41-50	Discharge	cfs.	Q		None
	6	F10.4	51-60	Total width of bars	ft.	B1		None
	7	F10.4	61-70	Loss coefficient		CC		Yes Program will compute appropriate value if this field is left blank

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
F card when ITYPE = 6 and ISECN = 1; omit otherwise (unit operations such as pumps, comminutors, flow measuring devices, etc.) (Prismatic section)								
	1	F10.4	1-10	Channel or conduit invert	ft.	ZO		None
	2	F10.4	11-20	Channel or conduit height (use 99 if open channel)	ft.	HT		None
	3	F10.4	21-30	Bottom width	ft.	B		None
	4	F10.4	31-40	Side slope	ft/ft.	SS		0.0
	5	F10.4	41-50	Discharge	cfs.	Q		None
	6	F10.4	51-60	Rated discharge	cfs.	QR		None
	7	F10.4	61-70	Rated head loss; negative value for pump head	ft.	RHLOS		None
F card when ITYPE = 6 and ISECN = 2; omit otherwise (unit operations, such as pumps, comminutors, flow measuring devices, etc.) (Circular section)								
	1	F10.4	1-10	Pipe invert	ft.	ZO		None
	2	F10.4	11-20	Pipe diameter	ft.	D		None
	3	F10.4	21-30	Discharge	cfs.	Q		None

TABLE C-1 (Continued). INPUT DATA DESCRIPTION

Card group	Entry	Format	Card columns	Description	Units	Variable name	Maximum value	Default value
F (cont)	4	F10.4	31-40	Rated discharge	cfs.	QR		None
	5	F10.4	41-50	Rated head loss; negative value for pump head	ft.	RHLOS		None
F card when ITYPE = 11 and ISECN = 1; omit otherwise (siphons with open channel or conduit upstream)								
	1	F10.4	1-10	Upstream channel or conduit invert	ft.	ZO		None
	2	F10.4	11-20	Channel or conduit height (use 99 for open channel)	ft.	HT		None
	3	F10.4	21-30	Bottom width	ft.	B		None
	4	F10.4	31-40	Side slope	ft/ft.	SS		0.0
F card when ITYPE = 11 and ISECN = 2; omit otherwise (siphons with pipe upstream)								
	1	F10.4	1-10	Pipe invert	ft.	ZO		None
	2	F10.4	11-20	Pipe diameter	ft.	D		None

Cards C through F must be repeated in sequence for every element in flow path from downstream to upstream. Only one F card is required for each element in the flow path. Select correct F card carefully.

Notes:

1. For junctions use contraction index for entrance and expansion index for inlet and junction box width = 99.0.
2. For sections at which invert drops suddenly use outfall index.
3. Several jobs can be processed in a single computer run by separating two jobs by placing a single blank card between them.

*Numbers must be right justified.

Where, h_{bar} = head loss in feet.

V = approach velocity before the bar screen, ft/sec.

K = head loss coefficient.

The head loss coefficient K is a function of the ratio of area of bars to area of flow cross-section and the shape of the bars. Loss coefficients for various shapes of bars have been determined experimentally and are presented in Hydraulic Design Criteria Design Chart 010-7, Corps of Engineers*.

Design chart 010-7 presents loss coefficient curves for six types of bar screens. Third order polynomial equations for loss coefficients were fitted through each of these curves and are used in the program. These equations are given below:

$K = 0.834\ A_r + 3.900\ A_r^2 + 6.920\ A_r^3$ For Type 1

$K = 0.760\ A_r + 1.689\ A_r^2 + 7.340\ A_r^3$ For Type 2

$K = 0.031\ A_r + 6.800\ A_r^2 + 0.514\ A_r^3$ For Type 3

$K = 0.209\ A_r + 4.790\ A_r^2 + 1.910\ A_r^3$ For Type 4

$K = -0.0895\ A_r + 3.266\ A_r^2 - .869\ A_r^3$ For Type 5

$K = 0.668\ A_r - 2.081\ A_r^2 + 8.496\ A_r^3$ For Type 6

In the above equations K is the loss coefficient and A_r is the ratio of area of bars to total area of cross-section.

The Bar Screen subroutine uses the loss coefficients calculated from the appropriate equation above. The user can use the coefficients determined by the program or can use his own coefficients. If the user leaves the input field for bar loss coefficient blank, the program will calculate the appropriate loss coefficient. However, if the user puts in a value for loss coefficient that value will be used by the program.

*Corps of Engineers-Hydraulic Design Criteria, U.S. Army Waterways Experiment Station, Vicksburg, Mississippi.

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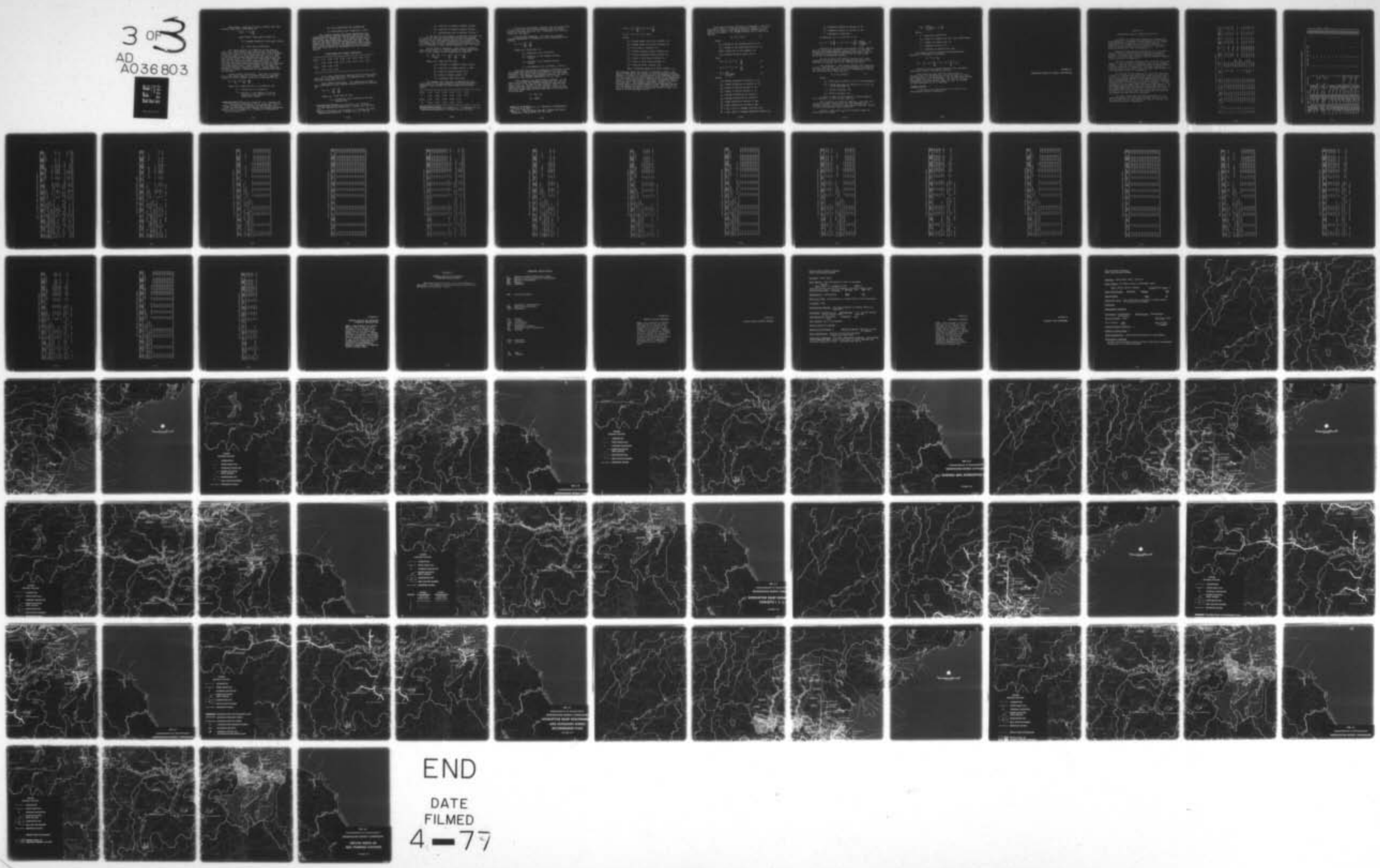

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Bend losses. Head loss in pipe, conduit, and open channel bends can be expressed* as:

$$h_{bend} = K_b \frac{\bar{V}^2}{2g}$$

Where h_{bend} = head loss in bend, ft.

$\bar{V}$ = average velocity in the bend, ft/sec.

K_b = bend loss coefficient.

The coefficient K_b is a function of the type of bend (e.g., miter bends, long radius bends, short radius bends, etc.) and also the type of flow such as open channel or closed conduit. A loss coefficient $K_b = 1.10$ is used in the computer program assuming that the bend is a miter bend (abrupt bend). For bends other than miter bends the user has to choose the correct loss coefficient. Curves for bend loss coefficients for different types of bends have been developed from experimental data and are presented in design charts 228-1, 228-2, 228-2/1 of the Corps of Engineers Hydraulic Design Criteria**. These charts may be used as a guide to determine the appropriate bend loss coefficients.

Closed Conduit Contraction. Head loss in contractions from closed conduit to closed conduit or from open channel to closed conduit flows can be expressed*** as:

$$H_L = \left(\frac{1}{C_c} - 1\right)^2 \frac{V^2}{2g} = \frac{KV^2}{2g}$$

Where, H_L = head loss due to contraction, ft.

C_c = coefficient of contraction

V = velocity in the smaller of the two conduits or the larger of the two velocities, ft/sec.

---

*"Steady Flow in Pipes and Conduits", V.L. Streeter, Ch. IV. Engineering Hydraulics, Ed. H. Rouse, pp. 413-415.

**Corps of Engineers - Hydraulic Design Criteria, U.S. Army Waterways Experiment Station, Vicksburg, Mississippi.

***King, H.W., & Brater, E.F., "Handbook of Hydraulics" pp. 8-31 (fifth ed.).

K = loss coefficient for contraction

g = acceleration due to gravity, ft/sec.

The computer program can supply appropriate loss coefficients or the user may decide to use his own loss coefficient for contraction. If the user decides not to use his own loss coefficient, the field for loss coefficient on the input data card should be left blank. The program will then calculate the appropriate loss coefficient based on the ratio of the areas of the two conduits. The loss coefficients are calculated from the following table.*

COEFFICIENTS FOR SUDDEN CONTRACTION

A_2/A_1	0.0	0.10	0.20	0.30	0.40	0.50	0.60	0.70
K	0.50	0.48	0.45	0.41	0.36	0.29	0.21	0.13
A_2/A_1	0.80	0.90	1.00					
K	0.07	0.01	0.00					

If the loss coefficient computed from the above table comes out to be less than 0.10, the program uses a contraction loss coefficient of 0.10.

Open Channel Contraction. The expression for head loss computation in open channel contraction can be written** as:

$$H_L = K_c \left(\frac{V_2^2}{2g} - \frac{V_1^2}{2g}\right)$$

Where, H_L = head loss in feet.

K_c = contraction loss coefficient for open channel flow

*"Steady Flow in Pipes and Conduits", V.L. Streeter, Ch. VI, Engineering Hydraulics, H. Rouse, Ed., pp. 413-415.

**Channel Transitions and Controls, A. T. Ippen, Ch. VIII, Engineering Hydraulics, H. Rouse, Ed., pp. 514-519.

V_2 = velocity in smaller channel, ft/sec.

V_1 = velocity in larger channel, ft/sec.

g = acceleration due to gravity, ft/sec.^{2}

In the case of open channel contraction, the user has to supply his own loss coefficient or else the program assumes that the open channel contraction is abrupt, and, therefore, uses the abrupt contraction coefficient of 0.50. For gradual open channel contracting loss coefficients the user is referred to open channel hydraulics by V. T. Chow.

Closed Conduit Expansion. Head loss in expansion from closed conduit to closed conduit or from closed conduit to open channel can be expressed* as follows:

$$H_L = \frac{V_1^2 - V_2^2}{2g} = \left(1 - \frac{A_1}{A_2}\right)^2 \frac{V_1^2}{2g} = K \frac{V_1^2}{2g}$$

Where, H_L = head loss in feet.

V_1 = velocity in smaller conduit ft/sec.

V_2 = velocity in larger conduit i /sec.

A_1 = area of smaller conduit ft.^{2}

A_2 = area of larger conduit ft.^{2}

K = expansion loss efficient.

The program will calculate an appropriate loss coefficient if the user leaves the input data field for expansion loss coefficient blank using the following table:

A_1/A_2	0.00	0.10	0.20	0.30	0.40	0.50
K	1.00	0.81	0.64	0.49	0.36	0.25
A_1/A_2	0.60	0.70	0.80	0.90	1.00	
K	0.16	0.09	0.04	0.01	0.00	

*Steady Flow in Pipes and Conduits, V. L. Streeter, Ch. VI, Engineering Hydraulics, H. Rouse, Ed., pp. 413-415.

If the loss coefficient computed from the above table is less than 0.20, the computer program uses for design purposes a minimum value of 0.20. Optionally the user may choose his own value.

Open Channel Expansion. The head loss in open channel enlargements or expansions can be expressed*,** as follows:

$$H_L = K_e \left(\frac{V_1^2}{2g} - \frac{V_2^2}{2g}\right)$$

Where, H_L = Head loss, ft.

K_e = Expansion loss coefficient

V_1 = Velocity in the smaller section, ft/sec.

V_2 = Velocity in the larger section, ft/sec.

g = Acceleration due to gravity, ft/sec.^{2}

The user must choose an expansion coefficient or else the program will assume that the expansion is abrupt and, therefore, will use a loss coefficient of 1.00 for sudden expansion. For gradual open channel expansion the user is referred to open channel hydraulics by V. T. Chow.

Pipe, Conduit, and Open Channel Outfalls. In the case of an outfall the program assumes that the velocity head, $V^2/2g$, of the flow is lost entirely when the flow leaves the pipe, conduit or open channel. Also, it is assumed that the flow velocity below the outfall is zero. Thus, the energy relation above and below the outfall can be written as:

$$E_1 = E_2 + h_e$$

$$h_e = V_1^2/2g$$

*King, H. W. & Brater, E. F., "Handbook of Hydraulics", pp. 8-31 Fifth Ed.

**Hinds, J., "The Hydraulic Design of Flume and Siphon Transition, Trans, ASCE, Vol. 92, 1928.

$$\text{or } Z_1 + Y_1 + \frac{V_1^2}{2g} = Z_2 + Y_2 + \frac{V_1^2}{2g}$$

$$\text{or } Z_1 + Y_1 = Z_2 + Y_2 = HGL_2$$

Where,

E_1 = Energy grade line above outfall, ft.

E_2 = Energy grade line below outfall, ft.

h_e = Head loss in outfall, ft.

Z_1 = Invert elevation above outfall, ft.

Z_2 = Invert elevation below outfall, ft.

Y_1 = Depth of flow above outfall, ft.

Y_2 = Depth of flow below outfall, ft.

V_1 = Velocity above outfall, fps.

HGL_2 = Hydraulic Grade Line below outfall, ft.

The hydraulic grade line below the outfall is known. The depth of flow above the outfall on then calculated directly. However, if there is a discontinuity in the hydraulic profile due to a drop then the above relation would not be applicable. In such a case, the depth of flow above the outfall would be equal to the critical depth in the pipe, conduit or channel for that flow. The program, therefore, checks to see whether there is any discontinuity in the hydraulic profile and calculates the correct depth of flow. The velocity of flow is calculated from the continuity equation ($A_1V_1 = Q$), where Q is the discharge in cfs.

Head Loss in Pipes, Conduits, and Channels. Head loss in a pipe, conduit, or channel segment of length ΔX is computed on the basis of the energy relation between the two ends of the segment. The energy relation can be written as follows:

$$E_1 = E_2 + \bar{S}_f \, \Delta X \qquad (1)$$

where,

E_1 = Energy at the upstream section, ft.

E_2 = Energy at the downstream section, ft.

$\bar{S}_f \Delta X$ = Head loss in the segment, ΔX

$\bar{S}_f$ = Average friction slope, ft/ft.

also,

$$E_1 = Z_1 + Y_1 + \alpha_1 \frac{V_1^2}{2g} \qquad (2)$$

$$E_2 = Z_2 + Y_2 + \alpha_2 \frac{V_2^2}{2g} \qquad (3)$$

$$\bar{S}_f = \frac{n^2 \bar{V}^2}{2.22 \, \bar{R}^{4/3}} \qquad (4)$$

where,

Z_1 = Invert elevation at section 1, ft.

Z_2 = Invert elevation at section 2, ft.

Y_1 = Depth of flow at section 1, ft.

Y_2 = Depth of flow at section 2, ft.

α_1 = Energy coefficient at section 1

α_2 = Energy coefficient at section 2

V_1 = Mean velocity at section 1, fps.

V_2 = Mean velocity at section 2, fps.

$\bar{V}$ = $(V_1 + V_2)/2$ = Average velocity, fps.

$\bar{R}$ = $(R_1 + R_2)/2$ = Average hydraulic radius, ft.

R_1 = Hydraulic radius at section 1, ft.

R_2 = Hydraulic radius at section 2, ft.

n = Manning's Coefficient

Introducing (2), (3), and (4) in (1).

$$Z_1 + Y_1 + \alpha_1^1 \frac{V_1^2}{2g} = Z_2 + Y_2 + \alpha_2 \frac{V_2^2}{2g} + \frac{n^2\overline{V}^2\Delta X}{2.22\overline{R}^{4/3}} \quad (5)$$

Equation (5) is solved by successive trials together with the continuity equation ($A_1V_1 = A_2V_2$). In the PHP program, the Newton-Raphson successive iteration technique is employed to solve for Y_1 and V_1 when Y_2, and V_2 are known for the downstream section.

In case of Pipes and Conduits flowing full, flow properties at either end of the segment are known and the solution of equation (5) can be obtained directly.

Unit Operations. Head losses through flow measuring devices, comminutors, etc., and head additions for pumps on the flow path are computed by the unit operations by using the following functional relation:

$$H_L = RH_L\ (Q/Q_R)^2 \quad (1)$$

Where,

H_L = Head loss or addition in ft. for discharge Q.

RH_L = Rated head loss or addition in ft. for the rated discharge Q_R.

Q = Actual discharge, cfs.

Q_R = Rated discharge, cfs.

In case of pumps on flow line RH_L becomes negative and, therefore, H_L also become negative.

Grit Chambers and Chlorine Chambers. Head loss and hydraulic profile computations for grit chambers and chlorine chambers are done as open channel segments, details of which are presented under Section 8.

Siphons. Head loss h_{LS}/in an inverted siphon is calculated as follows:

$$h_{es} = \frac{n^2 V^2 L}{2.22 R^{4/3}} + h_L \frac{V^2}{2g}$$

Where,

n = Manning's coefficient

h_L = Total of entrance and exit loss coefficients

L = Length of siphon pipe, ft.

R = Hydraulic radius, ft.

V = Velocity in siphon pipe, fps.

The energy relation between the downstream and upstream of the siphon is given as:

$$E_1 = E_2 + h_{es}$$

$$\text{or,} \quad Z_1 + Y_1 + \frac{V_1^2}{2g} = Z_2 + Y_2 + \frac{V_2^2}{2g} + h_{Ls}$$

Equation above is solved together with continuity equation by trial to determine Y_1 and V_1.

When there are more than one siphon pipes in parallel first the distribution of flow between the pipes are determined by the requirement that the head loss through each siphon pipe will be the same. For details of flow distribution between parallel pipes the user is referred to Fluid Mechanics by V. L. Streeter.

<u>Program Listing</u>

A listing of the PHPA Program is on file at the Metropolitan District Commission.

APPENDIX D

INTERCEPTOR MODELING EXAMPLE AND RESULTS

APPENDIX D

INTERCEPTOR MODELING EXAMPLE AND RESULTS

An example of interceptor modeling is presented in this appendix to illustrate the application of the instructions presented in Appendix C to an actual problem. For purposes of this example Sections 132 and 133B of the South Metropolitan System were selected (see Interceptor Modeling Package No. S-16 in Appendix B).

Table D-1 presents data pertaining to the physical system (extracted from Appendix A) used in the example problem. The capacities of each interceptor section as shown in this table were obtained from the computer analysis output presented in Table D-3.

Table D-2 presents the data shown in Table D-1 in the format in which it must be coded for input to the computer program. This was done in accordance with the user instructions as presented in Appendix C. The user instruction card designations are given along the right side of Table D-2 to permit easy review of the example.

The results of the computer run which are presented in Table D-3 reflect the actual flow conditions that occur within the existing physical system based on present peak flows as calculated during the flow quantification analysis (See Technical Data Vol. 2). This data is used to determine whether relief of the existing system is required. If such is found to be the case, relief pipes are sized based on the difference between peak design flow and system capacity. In this particular case, the hydraulic grade line (El 211.24) at station 5+87.00 in Section 132 is shown above the crown of the pipe (El 209.92), thus indicating that the sewer is surcharged and that relief is required.

The input data, card listings and results of the computer analysis for the North and South MSD systems are not contained within this report, but are on file with the Metropolitan District Commission.

TABLE D-1 INTERCEPTOR DATA USED FOR MODELING EXAMPLE

SECT NO	LOC	FROM STATION	INVERT (FT)	TO STATION	INVERT (FT)	SIZE (IN)	SHAPE	LENGTH (FT)	SLOPE	AREA (SQFT)	MANN N	CAPACITY (CFS)	CAPACITY (MGD)
132	NAT	0+04.00	204.80	4+70.00	205.12	48	CIRCULAR	466.00	0.000687	12.57	.013	37.78	24.42
132	NAT	4+70.00	205.12	5+87.00	205.92	2-27	SIPHON	117.00		7.96	.013	34.51	22.31
132	NAT	5+87.00	205.92	69+20.98	210.29	48	CIRCULAR	6333.98	0.000689	12.57	.013	37.78	24.42
132	NAT	69+20.98	210.29	71+45.98	211.53	2-27	SIPHON	225.00		7.96	.013	36.10	23.34
132	NAT	71+45.98	211.53	71+92.00	211.57	48	CIRCULAR	46.02	0.000869	12.57	.013	42.43	27.42
132	NAT	71+92.00	211.57	71+92.00	220.47		DROP MANHOLE						
132	NAT	71+92.00	220.47	79+82.00	221.00	48	CIRCULAR	790.00	0.000670	12.57	.013	37.29	24.10
132	NAT	79+82.00	221.00	79+82.00	224.72		DROP MANHOLE						
132	NAT	79+82.00	224.72	104+80.73	226.45	48	CIRCULAR	2498.73	0.000692	12.57	.013	37.86	24.47
133B	NAT	0+00.00	226.45	17+27.53	227.64	48	CIRCULAR	1727.53	0.000688	12.57	.013	37.78	24.42
133B	NAT	17+27.53	227.64	72+13.01	231.43	48X54	EXT. CIRCLE	5485.48	0.000690	14.57	.013	46.11	29.80
133B	NAT	72+13.01	231.43	96+24.71	232.74	48X54	EXT. CIRCLE	2411.70	0.000543	14.57	.013	40.95	26.47
133B	NAT	96+24.71	232.74	100+90.00	233.06	42	CIRCULAR	465.29	0.000687	9.62	.013	26.46	17.10
133B	NAT	100+90.00	233.06	130+87.56	235.13	48	CIRCULAR	2997.57	0.000690	12.57	.013	37.78	24.42

TABLE D-2 INPUT DATA FOR INTERCEPTOR MODELING EXAMPLE

```
------------------------------------------------------------------------------------------------
 2568 MDC COMB SEW & INT       ABU ALAM            SECTIONS 132 AND 133B                 CARD A
  205.00                                                                                 CARD B
 0+04.00   2+47.00 SECTION  132          2         2         2                   1       CARD C
    204.80       4.00       60.51                                                        CARD D
    243.00    .000686        .013        1                                               CARD F
 2+47.00   4+70.00 SECTION  132          2         2         2                   1       CARD C
    204.97       4.00       60.51                                                        CARD D
    223.00    .000686        .013        1                                               CARD F
   4+70.00   5+87.00 SIPHON SECTION   132 2        2        11                           CARD C
          2      60.51                                                                   CARD E1
    117.00       .013        2.25     2.25                                               CARD E2
    205.92       4.00                                                                    CARD F
  5+87.00 69+20.98 SECTION  132          2         2         2                           CARD C
   6353.98    .000689        .013       34                                               CARD F
69+20.98 71+45.98 SIPHON SECTION    132 2          2        11                           CARD C
          2      60.51                                                                   CARD E1
    225.00       .013        2.25     2.25                                               CARD E2
    211.53       4.00                                                                    CARD F
71+45.98 71+92.00 SECTION   132          2         2         2                   1       CARD C
    211.53       4.00       60.51                                                        CARD D
     46.02    .000869        .013        1                                               CARD F
71+92.00 79+82.00 SECTION   132          2         2         2                   1       CARD C
    220.47       4.00       60.51                                                        CARD D
    790.00    .000670        .013        4                                               CARD F
79+82.00 104+80.7 SECTION 132            2         2         2                   1       CARD C
    224.72       4.00       60.51                                                        CARD D
   2498.73    .000692        .013       12                                               CARD F
 0+00.00 17+27.53 SECTION   133B         2         2         2                   1       CARD C
    226.45       4.00       60.51                                                        CARD D
   1727.53    .000688        .013        9                                               CARD F
17+27.53 17+27.53 CONTRACTION SEC.133B 2           2         3         1                 CARD C
    227.64       4.31       60.51     0.50                                               CARD F
17+27.53 72+13.01 SECTION   133B         2         2         2                           CARD C
   5485.48    .000690        .013       27                                               CARD F
72+13.01 96+24.71 SECTION   133B         2         2         2                           CARD C
   2411.70    .000543        .013       12                                               CARD F
96+24.71 96+24.71 EXPANSION    SEC.133B 2          2         3         2                 CARD C
    232.74       3.50       60.51     1.00                                               CARD F
96+24.71 100+90.0 SECTION   133B         2         2         2                           CARD C
    465.29    .000687        .013        2                                               CARD F
100+90.0 100+90.0 CONTRACTION SEC.133B 2           2         3         1                 CARD C
    233.06       4.00       47.99     0.50                                               CARD F
100+90.0 130+87.5 SECTION   133B         2         2         2                           CARD C
   2997.57    .000690        .013       15                                               CARD F
------------------------------------------------------------------------------------------------
```

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.

LENGTH = 223.00 FT. SLOPE = 0.000686 NO. OF SEGMENTS = 1 LENGTH OF SEGMENT = 223.00 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.0000 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 37.70 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.004212

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 132 AT STATION 2+47.00 WITH CHANNEL- FLOW

FLOW DEPTH AT DOWNSTREAM END LARGER THAN CRITICAL DEPTH , YC = 2.3410 FT.

204.97	4.00		60.51	0.0130		3.37	1.21	11.28	5.36	0.4468	208.3406	208.7874	0.0007

FLOW PROPERTIES UPSTREAM---- OF SECTION 132 AT STATION 4+70.00 WITH CHANNEL- FLOW

205.12	4.00		60.51	0.0130		3.62	1.18	11.98	5.04	0.3955	208.7526	209.1482	0.3607

SIPHON SECTION 132 BETWEEN STATION 4+70.00 AND STATION 5+87.00

2 -- 2.2500 FT. DIAMETER INVERTED SIPHONS IN PARALLEL. FLOW PROPERTIES IN EACH PIPE AS BELOW &

	2.25		30.25			2.25	0.56	3.97	7.60	0.8990			2.4590

FLOW PROPERTIES UPSTREAM---- OF SIPHON SECTION 132 AT STATION 5+87.00 WITH PIPE---- FLOW

205.92	4.00		60.51			4.00	1.00	12.56	4.81	0.3600	211.2471	211.6072	2.4590

TABLE D-3 OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE..FT.	ENERGY GRADE ELE..FT.	HEAD LOSS FT.

SECTION 132 BETWEEN STATION 0+04.00 AND STATION 2+47.00

LENGTH = 243.00 FT. SLOPE = 0.000686 NO. OF SEGMENTS = 1 LENGTH OF SEGMENT = 243.00 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.0000 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 37.70 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.004212

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 132 AT STATION 0+04.00 WITH CHANNEL- FLOW

FLOW DEPTH AT DOWNSTREAM END EQUALS CRITICAL DEPTH , YC = 2.3410 FT.

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE..FT.	ENERGY GRADE ELE..FT.	HEAD LOSS FT.
204.80	4.00		60.51	0.0130		2.34	1.09	7.63	7.92	0.9742	207.1410	208.1153	3.1152

FLOW PROPERTIES UPSTREAM---- OF SECTION 132 AT STATION 2+47.00 WITH CHANNEL- FLOW

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE..FT.	ENERGY GRADE ELE..FT.	HEAD LOSS FT.
204.96	4.00		60.51	0.0130		3.37	1.21	11.28	5.35	0.4460	208.3406	208.7867	0.6714

SECTION 132 BETWEEN STATION 2+47.00 AND STATION 4+70.00

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

SECTION 132 BETWEEN STATION 5+87.00 AND STATION 69+20.98

LENGTH = 6353.98 FT. SLOPE = 0.000689 NO. OF SEGMENTS = 34 LENGTH OF SEGMENT = 186.88 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.0000 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 37.78 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.004212

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 132 AT STATION 5+87.00 WITH PIPE---- FLOW

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE..FT.	ENERGY GRADE ELE..FT.	HEAD LOSS FT.
205.92	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	211.2471	211.6072	-0.0000
206.04	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	211.5769	211.9370	0.3298
206.17	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	211.9068	212.2668	0.3298
206.30	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	212.2366	212.5967	0.3298
206.43	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	212.5664	212.9265	0.3298
206.56	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	212.8963	213.2563	0.3298
206.69	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	213.2261	213.5862	0.3298
206.82	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	213.5560	213.9160	0.3298
206.95	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	213.8858	214.2458	0.3298

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE..FT.	ENERGY GRADE ELE..FT.	HEAD LOSS FT.
207.07	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	214.2156	214.5757	0.3298
207.20	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	214.5455	214.9055	0.3298
207.33	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	214.8753	215.2353	0.3298
207.46	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	215.2051	215.5652	0.3298
207.59	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	215.5350	215.8950	0.3298
207.72	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	215.8648	216.2248	0.3298
207.85	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	216.1946	216.5547	0.3298
207.98	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	216.5245	216.8845	0.3298
208.10	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	216.8543	217.2143	0.3298
208.23	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	217.1841	217.5442	0.3298
208.36	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	217.5140	217.8740	0.3298
208.49	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	217.8438	218.2038	0.3298
208.62	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	218.1736	218.5337	0.3298
208.75	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	218.5035	218.8635	0.3298
208.88	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	218.8333	219.1933	0.3298
209.01	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	219.1631	219.5232	0.3298

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.
209.13	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	219.4930	219.8530	0.3298
209.26	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	219.8228	220.1828	0.3298
209.39	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	220.1526	220.5127	0.3298
209.52	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	220.4825	220.8425	0.3298
209.65	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	220.8123	221.1723	0.3298
209.78	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	221.1421	221.5022	0.3298
209.91	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	221.4720	221.8320	0.3298
210.04	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	221.8018	222.1618	0.3298
210.16	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	222.1316	222.4917	0.3298

FLOW PROPERTIES UPSTREAM---- OF SECTION 132 AT STATION 69+20.98 WITH PIPE---- FLOW

210.29	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	222.4615	222.8215	0.3298

SIPHON SECTION 132 BETWEEN STATION 69+20.98 AND STATION 71+45.98

2 -- 2.2500 FT. DIAMETER INVERTED SIPHONS IN PARALLEL. FLOW PROPERTIES IN EACH PIPE AS BELOW &

	2.25		30.25			2.25	0.56	3.97	7.60	0.8990			3.4840

FLOW PROPERTIES UPSTREAM---- OF SIPHON SECTION 132 AT STATION 71+45.98 WITH PIPE---- FLOW

211.53	4.00		60.51			4.00	1.00	12.56	4.81	0.3600	225.9455	226.3056	3.4840

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE..FT.	ENERGY GRADE ELE..FT.	HEAD LOSS FT.

SECTION 132 BETWEEN STATION 71+45.98 AND STATION 71+92.00

LENGTH = 46.02 FT. SLOPE = 0.000869 NO. OF SEGMENTS = 1 LENGTH OF SEGMENT = 46.02 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.0000 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 42.43 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.004212

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 132 AT STATION 71+45.98 WITH PIPE---- FLOW

211.53	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	225.9455	226.3055	-0.0000

FLOW PROPERTIES UPSTREAM---- OF SECTION 132 AT STATION 71+92.00 WITH PIPE---- FLOW

211.57	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	226.0267	226.3867	0.0812

SECTION 132 BETWEEN STATION 71+92.00 AND STATION 79+82.00

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.

LENGTH = 790.00 FT. SLOPE = 0.000670 NO. OF SEGMENTS = 4 LENGTH OF SEGMENT = 197.50 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.0000 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 37.26 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.004212

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 132 AT STATION 71+92.00 WITH PIPE---- FLOW

220.47	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	226.0267	226.3867	-0.0000
220.60	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	226.3753	226.7353	0.3486
220.73	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	226.7239	227.0839	0.3486
220.86	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	227.0725	227.4325	0.3486

FLOW PROPERTIES UPSTREAM---- OF SECTION 132 AT STATION 79+82.00 WITH PIPE---- FLOW

220.99	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	227.4211	227.7811	0.3486

SECTION 132 BETWEEN STATION 79+82.00 AND STATION 104+80.7

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.

LENGTH = 2498.73 FT. SLOPE = 0.000692 NO. OF SEGMENTS = 12 LENGTH OF SEGMENT = 208.22 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.0000 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 37.86 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.004212

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 132 AT STATION 79+82.00 WITH CHANNEL- FLOW

FLOW DEPTH AT DOWNSTREAM END LARGER THAN CRITICAL DEPTH , YC = 2.3410 FT.

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.
224.72	4.00		60.51	0.0130		2.70	1.16	9.02	6.70	0.6977	227.4211	228.1188	0.3377
224.86	4.00		60.51	0.0130		3.24	1.21	10.88	5.55	0.4797	228.1099	228.5896	0.4707
225.00	4.00		60.51	0.0130		3.52	1.19	11.71	5.16	0.4143	228.5289	228.9433	0.3537
225.15	4.00		60.51	0.0130		3.73	1.16	12.17	4.97	0.3837	228.8855	229.2693	0.3259
225.29	4.00		60.51	0.0130		3.94	1.04	12.48	4.84	0.3645	229.2398	229.6044	0.3351
225.44	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	229.6039	229.9640	0.3596
225.58	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	229.9714	230.3315	0.3675
225.72	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	230.3390	230.6990	0.3675
225.87	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	230.7065	231.0665	0.3675
226.01	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	231.0740	231.4341	0.3675

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.
226.16	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	231.4415	231.8016	0.3675
226.30	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	231.8091	232.1691	0.3675

FLOW PROPERTIES UPSTREAM---- OF SECTION 132 AT STATION 104+80.7 WITH PIPE---- FLOW

226.44	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	232.1766	232.5366	0.3675

SECTION 133B BETWEEN STATION 0+00.00 AND STATION 17+27.53

LENGTH = 1727.53 FT. SLOPE = 0.000688 NO. OF SEGMENTS = 9 LENGTH OF SEGMENT = 191.94 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.0000 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 37.75 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.004212

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 133B AT STATION 0+00.00 WITH PIPE---- FLOW

226.45	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	232.1766	232.5366	-0.0000
226.58	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	232.5153	232.8754	0.3388
226.71	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	232.8541	233.2142	0.3388
226.84	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	233.1929	233.5529	0.3388
226.97	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	233.5317	233.8917	0.3388

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. .FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.
227.11	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	233.8704	234.2305	0.3388
227.24	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	234.2092	234.5693	0.3388
227.37	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	234.5480	234.9080	0.3388
227.50	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	234.8868	235.2468	0.3388
FLOW PROPERTIES UPSTREAM---- OF SECTION 133B AT STATION 17+27.53 WITH PIPE---- FLOW													
227.63	4.00		60.51	0.0130		4.00	1.00	12.56	4.81	0.3600	235.2255	235.5856	0.3388
CONTRACTION SEC.133B BETWEEN STATION 17+27.53 AND STATION 17+27.53													
FLOW PROPERTIES UPSTREAM---- OF CONTRACTION SEC.133B AT STATION 17+27.53 WITH PIPE---- FLOW													
227.64	4.31		60.51		0.500	4.31	1.07	14.58	4.14	0.2671	235.4984	235.7655	0.1800

SECTION 133B BETWEEN STATION 17+27.53 AND STATION 72+13.01

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.

LENGTH = 5485.48 FT. SLOPE = 0.000690 NO. OF SEGMENTS = 27 LENGTH OF SEGMENT = 203.16 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.3100 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 46.14 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.003982

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 1338 AT STATION 17+27.53 WITH PIPE---- FLOW

227.64	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	235.4984	235.7655	-0.0000
227.78	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	235.7392	236.0063	0.2408
227.92	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	235.9800	236.2471	0.2408
228.06	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	236.2208	236.4880	0.2408
228.20	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	236.4617	236.7288	0.2408
228.34	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	236.7025	236.9696	0.2408
228.48	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	236.9433	237.2104	0.2408
228.62	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	237.1841	237.4512	0.2408
228.76	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	237.4249	237.6920	0.2408
228.90	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	237.6657	237.9328	0.2408
229.04	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	237.9065	238.1737	0.2408

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE..FT.	ENERGY GRADE ELE..FT.	HEAD LOSS FT.
229.18	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	238.1474	238.4145	0.2408
229.32	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	238.3882	238.6553	0.2408
229.46	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	238.6290	238.8961	0.2408
229.60	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	238.8698	239.1369	0.2408
229.74	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	239.1106	239.3777	0.2408
229.88	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	239.3514	239.6185	0.2408
230.02	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	239.5922	239.8594	0.2408
230.16	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	239.8330	240.1002	0.2408
230.30	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	240.0739	240.3410	0.2408
230.44	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	240.3147	240.5818	0.2408
230.58	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	240.5555	240.8226	0.2408
230.72	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	240.7963	241.0634	0.2408
230.86	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	241.0371	241.3042	0.2408
231.00	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	241.2779	241.5451	0.2408
231.14	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	241.5187	241.7859	0.2408
231.28	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	241.7596	242.0267	0.2408

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.
FLOW PROPERTIES UPSTREAM---- OF SECTION 133B						AT	STATION	72+13.01	WITH	PIPE---- FLOW			
231.42	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	242.0004	242.2675	0.2408

SECTION 133B BETWEEN STATION 72+13.01 AND STATION 96+24.71

LENGTH = 2411.70 FT. SLOPE = 0.000543 NO. OF SEGMENTS = 12 LENGTH OF SEGMENT = 200.97 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.3100 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 40.93 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.003982

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.
FLOW PROPERTIES DOWNSTREAM-- OF SECTION 133B						AT	STATION	72+13.01	WITH	PIPE---- FLOW			
231.42	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	242.0004	242.2675	-0.0000
231.53	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	242.2386	242.5057	0.2382
231.64	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	242.4768	242.7439	0.2382
231.75	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	242.7150	242.9821	0.2382
231.86	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	242.9532	243.2203	0.2382
231.97	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	243.1914	243.4586	0.2382
232.07	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	243.4297	243.6968	0.2382

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.
232.18	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	243.6679	243.9350	0.2382
232.29	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	243.9061	244.1732	0.2382
232.40	4.31		6C.51	0.0130		4.31	1.07	14.58	4.14	0.2671	244.1443	244.4114	0.2382
232.51	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	244.3825	244.6497	0.2382
232.62	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	244.6208	244.8879	0.2382
FLOW PROPERTIES UPSTREAM---- OF SECTION 133B AT STATION 96+24.71 WITH PIPE---- FLOW													
232.73	4.31		60.51	0.0130		4.31	1.07	14.58	4.14	0.2671	244.8590	245.1261	0.2382
EXPANSION SEC.133B BETWEEN STATION 96+24.71 AND STATION 96+24.71													
FLOW PROPERTIES UPSTREAM---- OF EXPANSION SEC.133B AT STATION 96+24.71 WITH PIPE---- FLOW													
232.74	3.50		60.51		1.000	3.50	0.87	9.62	6.28	0.6142	245.1260	245.7403	0.6142

SECTION 133B BETWEEN STATION 96+24.71 AND STATION 100+90.0

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.

LENGTH = 465.29 FT. SLOPE = 0.000687 NO. OF SEGMENTS = 2 LENGTH OF SEGMENT = 232.64 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 3.5000 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 26.42 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.005205

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 133B AT STATION 96+24.71 WITH PIPE---- FLOW

232.74	3.50		60.51	0.0130		3.50	0.87	9.62	6.28	0.6142	245.1260	245.7402	-0.0000
232.89	3.50		60.51	0.0130		3.50	0.87	9.62	6.28	0.6142	245.9630	246.5773	0.8370

FLOW PROPERTIES UPSTREAM---- OF SECTION 133B AT STATION 100+90.0 WITH PIPE---- FLOW

233.05	3.50		60.51	0.0130		3.50	0.87	9.62	6.28	0.6142	246.8000	247.4143	0.8370

CONTRACTION SEC.133B BETWEEN STATION 100+90.0 AND STATION 100+90.0

FLOW PROPERTIES UPSTREAM---- OF CONTRACTION SEC.133B AT STATION 100+90.0 WITH PIPE---- FLOW

233.06	4.00		47.99		0.500	4.00	1.00	12.56	3.81	0.2264	247.4949	247.7213	0.3071

SECTION 133B BETWEEN STATION 100+90.0 AND STATION 130+87.5

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE.,FT.	ENERGY GRADE ELE.,FT.	HEAD LOSS FT.

LENGTH = 2997.57 FT. SLOPE = 0.000690 NO. OF SEGMENTS = 15 LENGTH OF SEGMENT = 199.83 FT.

NORMAL DEPTH IN CHANNEL , CONDUIT , OR PIPE YN = 4.0000 FT.
CONDUIT OR PIPE FULL CAPACITY QFULL = 37.81 CFS

BOTTOM SLOPE LESS THAN CRITICAL SLOPE SC = 0.004009

FLOW PROPERTIES DOWNSTREAM-- OF SECTION 133B AT STATION 100+90.0 WITH PIPE---- FLOW

233.06	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	247.4949	247.7213	-0.0000
233.19	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	247.7167	247.9432	0.2218
233.33	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	247.9385	248.1650	0.2218
233.47	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	248.1604	248.3869	0.2218
233.61	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	248.3823	248.6087	0.2218
233.74	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	248.6041	248.8306	0.2218
233.88	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	248.8260	249.0525	0.2218
234.02	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	249.0479	249.2743	0.2218
234.16	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	249.2697	249.4962	0.2218
234.30	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	249.4916	249.7181	0.2218
234.43	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	249.7135	249.9399	0.2218

TABLE D-3 (CONTINUED) OUTPUT FROM INTERCEPTOR MODELING EXAMPLE

INVERT ELEV. FT.	B. WIDTH OR DIAM. FT.	SIDE SLOPE HR/VT	FLOW CFS.	MANNING COEF. N	LOSS COEF.	DEPTH OF FLOW FT.	HYDRA. RADIUS FT.	FLOW AREA SQ.FT.	VELOCITY FPS.	VELOCITY HEAD FT.	WATER SURFACE ELE..FT.	ENERGY GRADE ELE..FT.	HEAD LOSS FT.
234.57	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	249.9353	250.1618	0.2218
234.71	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	250.1572	250.3836	0.2218
234.85	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	250.3790	250.6055	0.2218
234.99	4.00		47.99	0.0130		4.00	1.0C	12.56	3.81	0.2264	250.6009	250.8274	0.2218
FLOW PROPERTIES UPSTREAM---- OF SECTION 133B AT STATION 130+87.5 WITH PIPE---- FLOW													
235.12	4.00		47.99	0.0130		4.00	1.00	12.56	3.81	0.2264	250.8228	251.0492	0.2218

APPENDIX E

PUMPING STATION AND HEADWORKS INVENTORY ABBREVIATIONS

NOTE: This appendix to Technical Data Vol. 9 has not been included in all copies of the report due to the nature and length of its content. However, in order to acquaint the reader with its content the first sheet of the abbreviation is included. A copy of the abbreviations and inventories is available for review at the Metropolitan District Commission, 20 Somerset Street, Boston, Mass.

APPENDIX E

PUMPING STATION AND HEADWORKS INVENTORY ABBREVIATIONS

The following abbreviations were used during the inventory of the pumping station and headworks facilities and appear in Appendixes F and G.

INVENTORY ABBREVIATIONS

A.	Amperes or Amber (Indicating light)
AGMA.	American Gear Manufacturers Association
Amb.	Ambient (temperature)
Arm.	Armature
Auto.	Automatic
BHP.	Boiler horsepower
C.	Centigrade (temperature)
CFM.	Cubic Feet per Minute
Cont.	Continuous
Des.	Design
Dia.	Diameter
Diff.	Differential
Disc.	Disconnect
DP.	Discharge pressure
DP.	Dripproof (Motor Enclosure)
Dwg.	Drawing
Elev.	Elevation
Exp.	Explosion
Ft.	Feet
Fwd.	Forward

APPENDIX F

PUMPING STATION INVENTORY

NOTE: This appendix to Technical Data Vol. 9 has not been included in all copies of the report due to the nature and length of its content. However, in order to acquaint the reader with its content the first sheet of the inventory is included. A copy of the inventory is available for review at the Metropolitan District Commission, 20 Somerset Street, Boston, Mass.

SECTION 1

ALEWIFE BROOK PUMPING STATION

Alewife Brook Pumping Station
Power Distribution System

Location First floor

Power Supply From substation in rear of building

From Boston Edison Co. Voltage 4,160 Phase 3

from two sources through an automatic transfer switch to the

Power Transformers Quantity 2 Voltage 460 KVA 225

Manufacturer Westinghouse Taps % Z

Other N.P. Data Transformers in locked yard are not accessible.

Condition Fair

Maintenance Comments Some deterioration of Boston Edison Co. equipment.

Switchgear Cabinetrol and control panel (MCC) Manufacturer G. E. and G&N Switchgear Div.

Identification Trademarks only Condition Good

Main Breaker 600 A Westinghouse

Useable Spares or Spaces 4

Number of Structures 7 Space for Future Room for 5 more, if needed.

Other Information Remotely controlled automatic system not being used.

Maintenance Comments Very well maintained equipment. Where power enters basement wall, water enters pull box when raining, and requires cleaning of floor. Corrosion has set in.

APPENDIX G

HEADWORKS INVENTORY

NOTE: This appendix to Technical Data Vol. 9 has not been included on all copies of the report due to the nature and length of its content. However, in order to acquaint the reader with its contents the first sheet of the inventory is enclosed. A copy of the inventory is available for review at the Metropolitan District Commission, 20 Somerset Street, Boston, Mass.

SECTION 1

CHELSEA CREEK HEADWORKS

Chelsea Creek Headworks
Power Distribution System

Location First Floor (Elev. 117.12')

Power Supply To common access transformer vault.

From Boston Edison Company Voltage 4160 Phase 3

Power Transformer Quantity Voltage KVA

Manufacturer Taps %Z

Other N.P. Data Key could not be located to obtain access. No information available

Condition

Maintenance Comments

Switchgear Distribution Switchboard Manufacturer Westinghouse

Identification None Condition Good

Main Breaker 1000/1600 Date of Mfr. Unknown

Useable Spares or Spaces 7

Number of Structures 7

Other Information Boston Edison Metering on switchboard

Maintenance Comments

Several circuit breaker panel sections within this switchboard supply all of the building loads

1

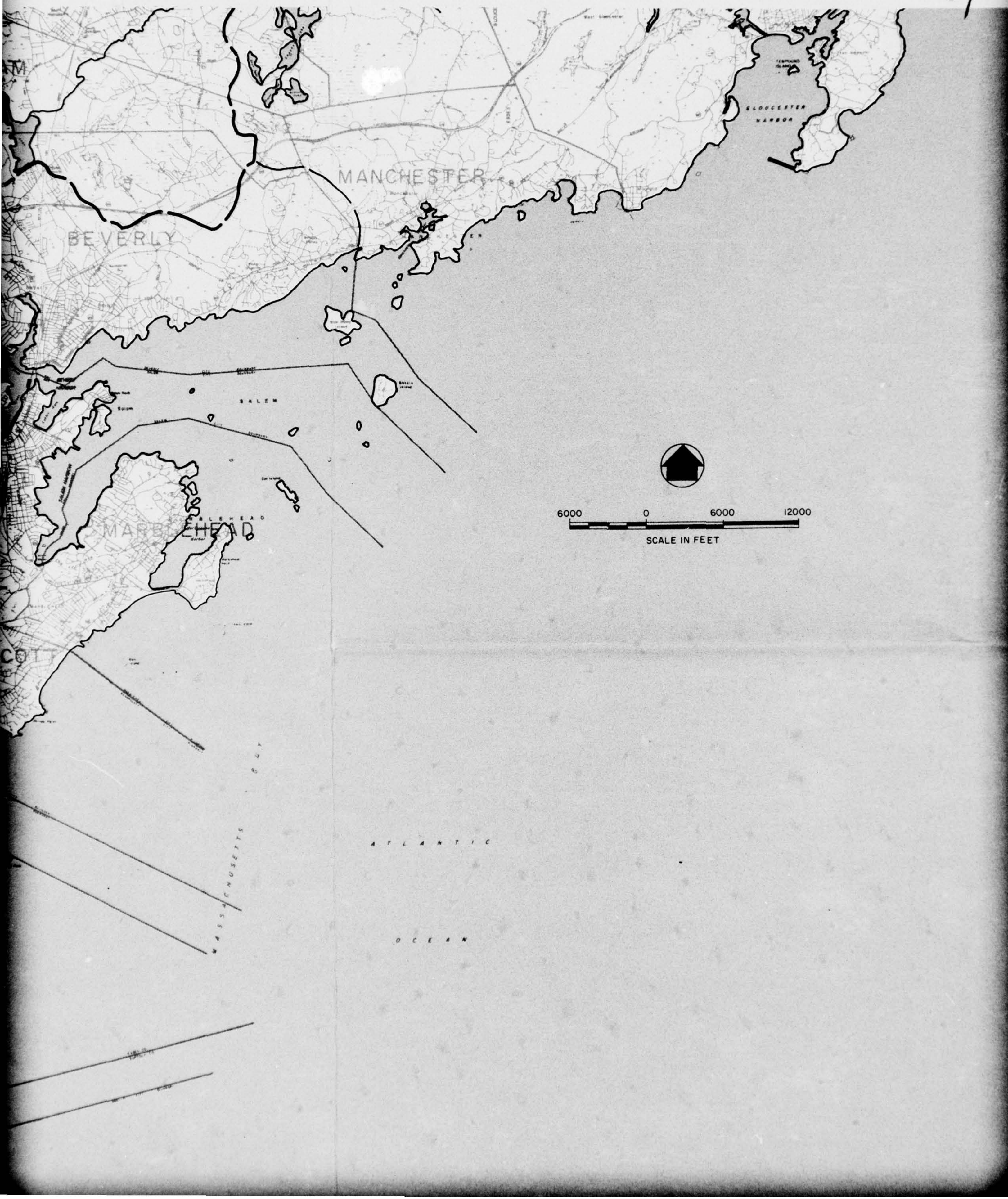

Stony
Brook
CHELMSFORD
River
WESTFORD
CARLISLE
LITTLETON
BOXBOROUGH
ACTON
CONCORD
N
STOW
Assabet
River
MAYNARD
HUDSON
River
River
SUDBURY

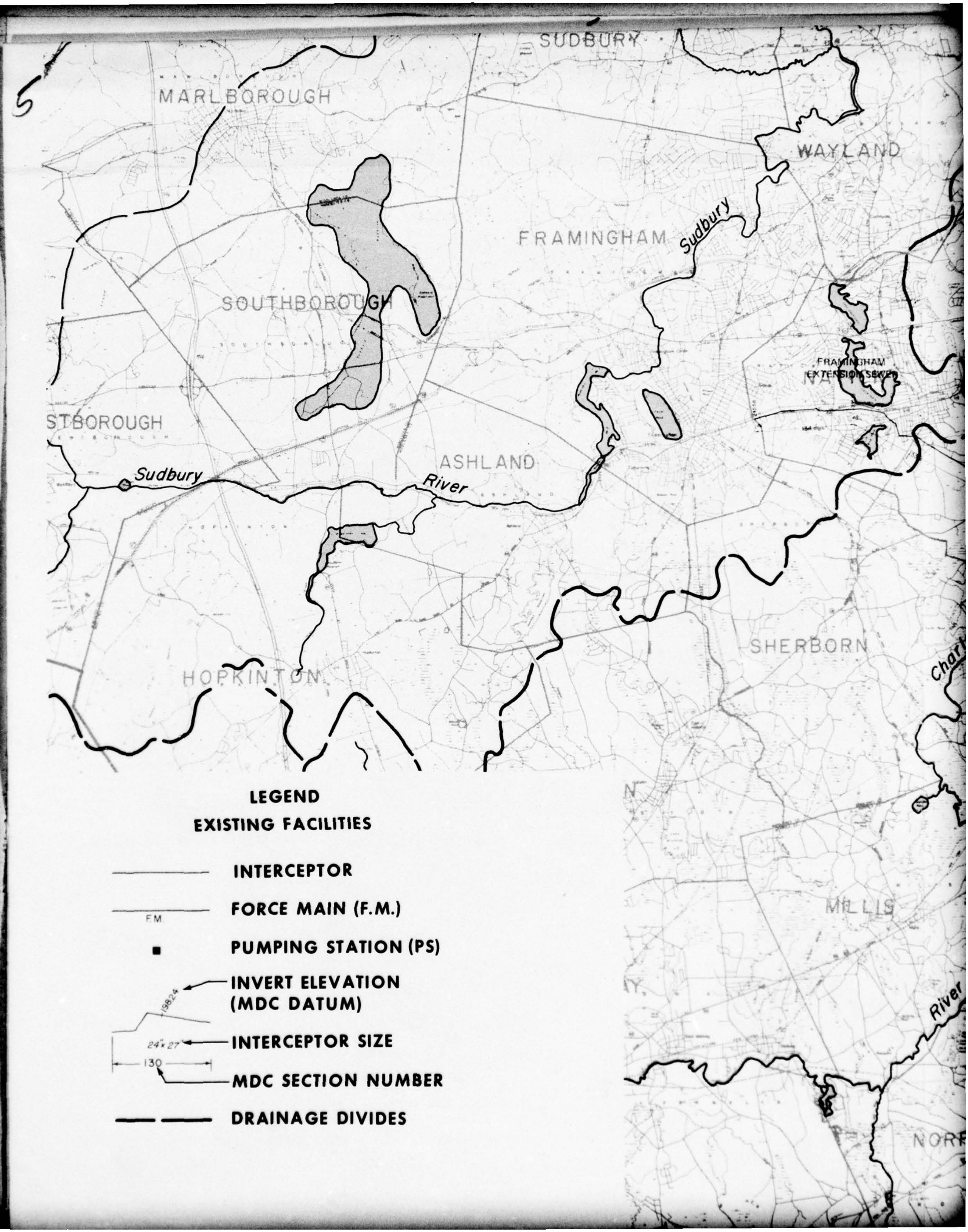
2

TEWKSBURY
CHELMSFORD
River Medow
River
River
River
CARLISLE
BILLERICA
WILMINGTON
Ipswich
Concord
Shawsheen
BURLINGTON
BEDFORD
CONCORD
WOBURN
Aberjona River
CUMMINGSVILLE BRANCH SEWER
WINCHESTER
MILLBROOK VALLEY SEWER
NORTH METRO SEWER
LEXINGTON
LINCOLN
ARLINGTON
LEXINGTON BRANCH SEWER
BELMONT
WALTHAM
CAMBRIDGE
River
Charles
WATERTOWN
NORTH CHARLES RELIEF SEWER

3

MIDDLETON
WENHAM
NORTH READING
DANVERS
River
Ipswich
READING
LYNNFIELD
PEABODY
READING P.S.
WILMINGTON EXTENSION SEWER
READING EXTENSION SEWER
WAKEFIELD
Saugus
SALEM
LYNN
NORTH METRO RELIEF SEWER
SWAMPSCOTT
Aberjona River
River
SAUGUS
STONEHAM EXTENSION SEWER
MELROSE
WAKEFIELD BRANCH SEWER
WAKEFIELD BRANCH RELIEF SEWER
STONEHAM TRUNK SEWER
WAKEFIELD TRUNK SEWER
MALDEN BRANCH SEWER
MALDEN RELIEF SEWER
NAHANT
MEDFORD
Mystic
REVERE
NORTH METRO SEWER
CHELSEA BRANCH SEWER
REVERE EXTENSION SEWER
EVERETT
ALEWIFE BROOK P.S.
CHELSEA CREEK HDWKS.
SOMERVILLE MEDFORD BRANCH SEWER
EAST BOSTON STEAM P.S.
River
CHARLESTOWN P.S.
NORTH METRO SEWER
CAMBRIDGE
NORTH CHARLES METRO SEWER
WINTHROP
NORTH METRO RELIEF
EAST BOSTON ELECTRIC P.S.
CAMBRIDGE BRANCH SEWER
CHARLESTOWN BRANCH SEWER


MANCHESTER
BEVERLY
MARBLEHEAD
SALEM
GLOUCESTER HARBOR
6000 0 6000 12000
SCALE IN FEET
MASSACHUSETTS BAY
ATLANTIC
OCEAN


5
SUDBURY
MARLBOROUGH
WAYLAND
FRAMINGHAM
Sudbury
SOUTHBOROUGH
FRAMINGHAM EXTENSION SEWER
STBOROUGH
ASHLAND
Sudbury
River
SHERBORN
HOPKINTON
MILLIS
River
LEGEND
EXISTING FACILITIES
INTERCEPTOR
FORCE MAIN (F.M.)
F.M.
PUMPING STATION (PS)
INVERT ELEVATION (MDC DATUM)
198.24
INTERCEPTOR SIZE
24"x 27"
130
MDC SECTION NUMBER
DRAINAGE DIVIDES

NORTH CHARLES RELIEF SEWER
SOUTH CHARLES RELIEF SEWER
CHARLES RIVER VALLEY SEWER
BRIGHTON BRANCH SEWER
WESTON
NEWTON
BROOKLINE
WELLESLEY
FRAMINGHAM EXTENSION SEWER
NEEDHAM
UPPER NEPONSET VALLEY SEWER
River
WELLESLEY EXTENSION RELIEF SEWER
WELLESLEY EXTENSION SEWER
WELLESLEY EXTENSION RELIEF SEWER
NEPONSET VALLEY SEWER
Charles
DOVER
WESTWOOD
WESTWOOD EXTENSION SEWER
Neponset
MILTON
MEDFIELD
NORWOOD
CANTON
WALPOLE
River
WALPOLE EXTENSION SEWER
STOUGHTON EXTENSION SEW
River
Neponset
NORFOLK
SHARON

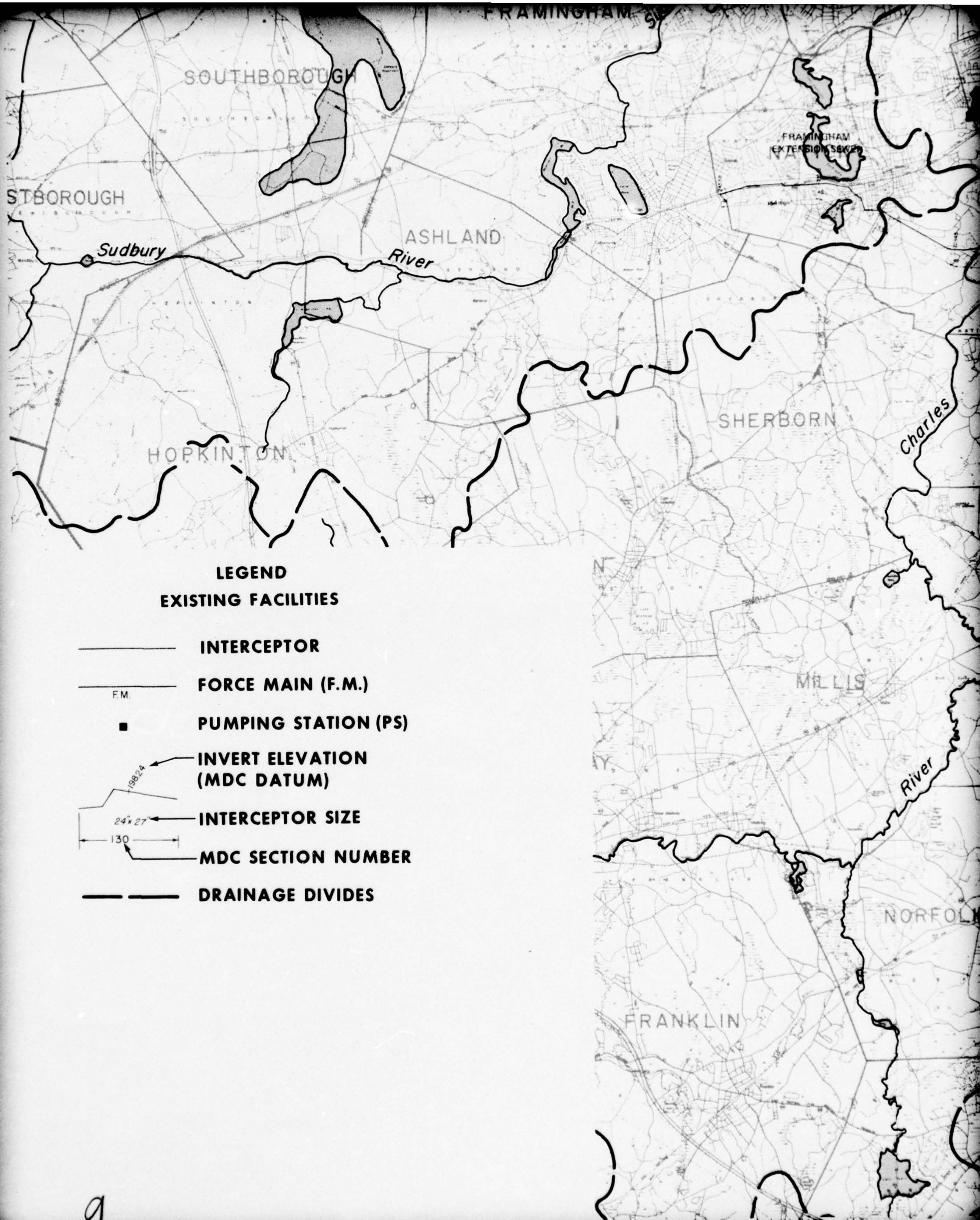
ELECTRIC P.S.
CHARLESTOWN BRANCH SEWER
RELIEF TUNNEL
7
WINTHROP TERMINAL FACILITY
DEER ISLAND WWTP
River
CHARLES RIVER CROSSING
SOUTH CHARLES RELIEF SEWER
WARD STREET HEADWORKS
BOSTON MAIN DRAINAGE TUNNEL
COLUMBUS PARK HEADWORKS
CALF PASTURE P.S.
BOSTON
SQUANTUM P.S.
HULL
NUT ISLAND WWTP.
HOUGHS NECK P.S.
River
QUINCY P.S.
BRAINTREE-WEYMOUTH P.S.
BRAINTREE-WEYMOUTH EXTENSION SEWER
HIGH LEVEL SEWER
QUINCY
HINGHAM P.S.
NEW NEPONSET VALLEY SEWER
Neponset
MILTON
LOWER BRAINTREE CONNECTING SEWER
HINGHAM F.M.
Weymouth Fore River
Back River
Weymouth
HINGHAM
BRAINTREE
BRAINTREE-RANDOLPH EXTENSION SEWER
WEYMOUTH
STOUGHTON EXTENSION SEWER
ROCKLAND
STOUGHTON

8

FIG. 2-2

COMMONWEALTH OF MASSACHU

METROPOLITAN DISTRICT COM


FRAMINGHAM
SOUTHBOROUGH
STBOROUGH
ASHLAND
Sudbury
River
HOPKINTON
SHERBORN
Charles
River
MILLIS
NORFOL
FRANKLIN
LEGEND
EXISTING FACILITIES
INTERCEPTOR
FORCE MAIN (F.M.)
F.M.
PUMPING STATION (PS)
INVERT ELEVATION
(MDC DATUM)
198.24
INTERCEPTOR SIZE
24"x 27"
130
MDC SECTION NUMBER
DRAINAGE DIVIDES

9

BROOKLINE
BOSTON
WELLESLEY
FRAMINGHAM EXTENSION SEWER
NEEDHAM
UPPER NEPONSET VALLEY SEWER
River
WELLESLEY EXTENSION RELIEF SEWER
WELLESLEY EXTENSION SEWER
WELLESLEY EXTENSION RELIEF SEWER
DEDHAM
NEPONSET VALLEY SEWER
Neponset
MILTON
BORN
Charles
DOVER
WESTWOOD
WESTWOOD EXTENSION SEWER
MEDFIELD
NORWOOD
CANTON
MILLIS
WALPOLE
River
WALPOLE EXTENSION SEWER
STOUGHTON EXTENSION SEWER
River
Neponset
NORFOLK
SHARON
STOUGHTON

CALF PASTURE P.S.
BOSTON
SQUANTUM P.S.
HULL
NUT ISLAND WWTP.
HOUGHS NECK P.S.
NEPONSET VALLEY SEWER
WELLESLEY EXTENSION RELIEF SEWER
River
QUINCY P.S.
BRAINTREE-WEYMOUTH P.S.
BRAINTREE-WEYMOUTH EXTENSION SEWER
HIGH LEVEL SEWER
QUINCY
NEW NEPONSET VALLEY SEWER
HINGHAM P.S.
HINGHAM F.M.
LOWER BRAINTREE CONNECTING SEWER
VALLEY SEWER
Neponset
MILTON
Weymouth
Fore
River
Back
Weymouth
River
HINGHAM
BRAINTREE
BRAINTREE-RANDOLPH EXTENSION SEWER
WEYMOUTH
CANTON
STOUGHTON EXTENSION SEWER
ROCKLAND
STOUGHTON

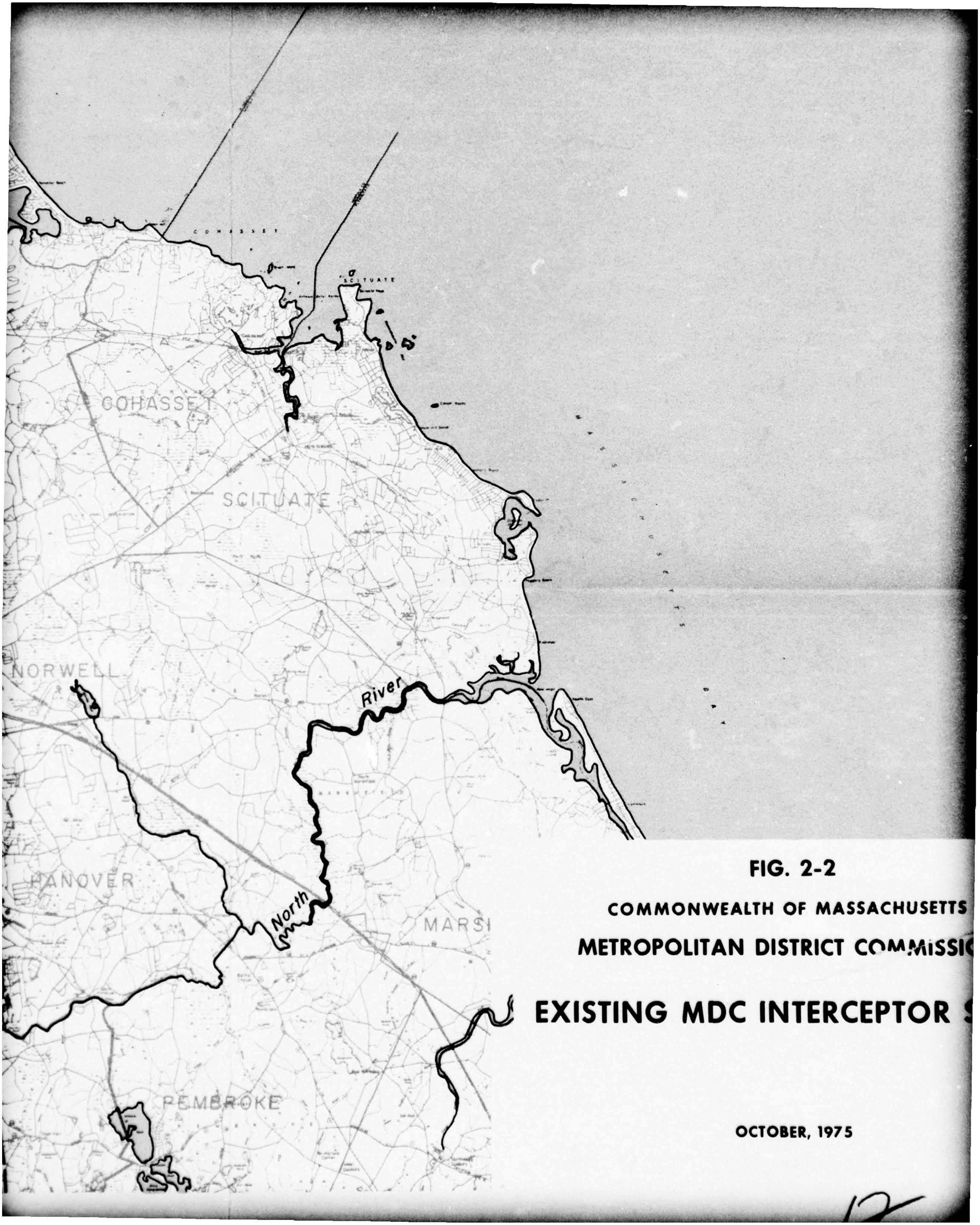


FIG. 2-2

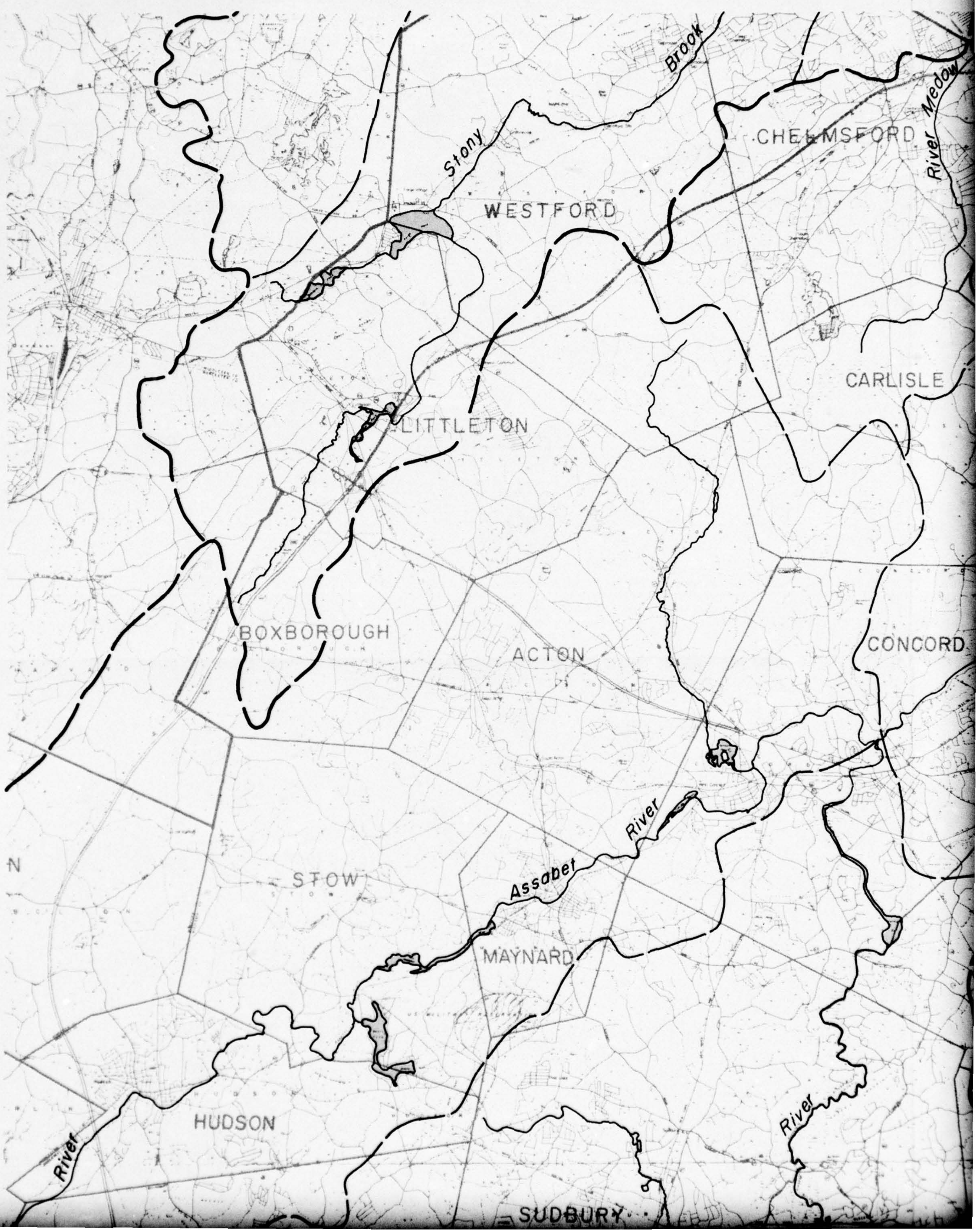
COMMONWEALTH OF MASSACHUSETTS

METROPOLITAN DISTRICT COMMISSI

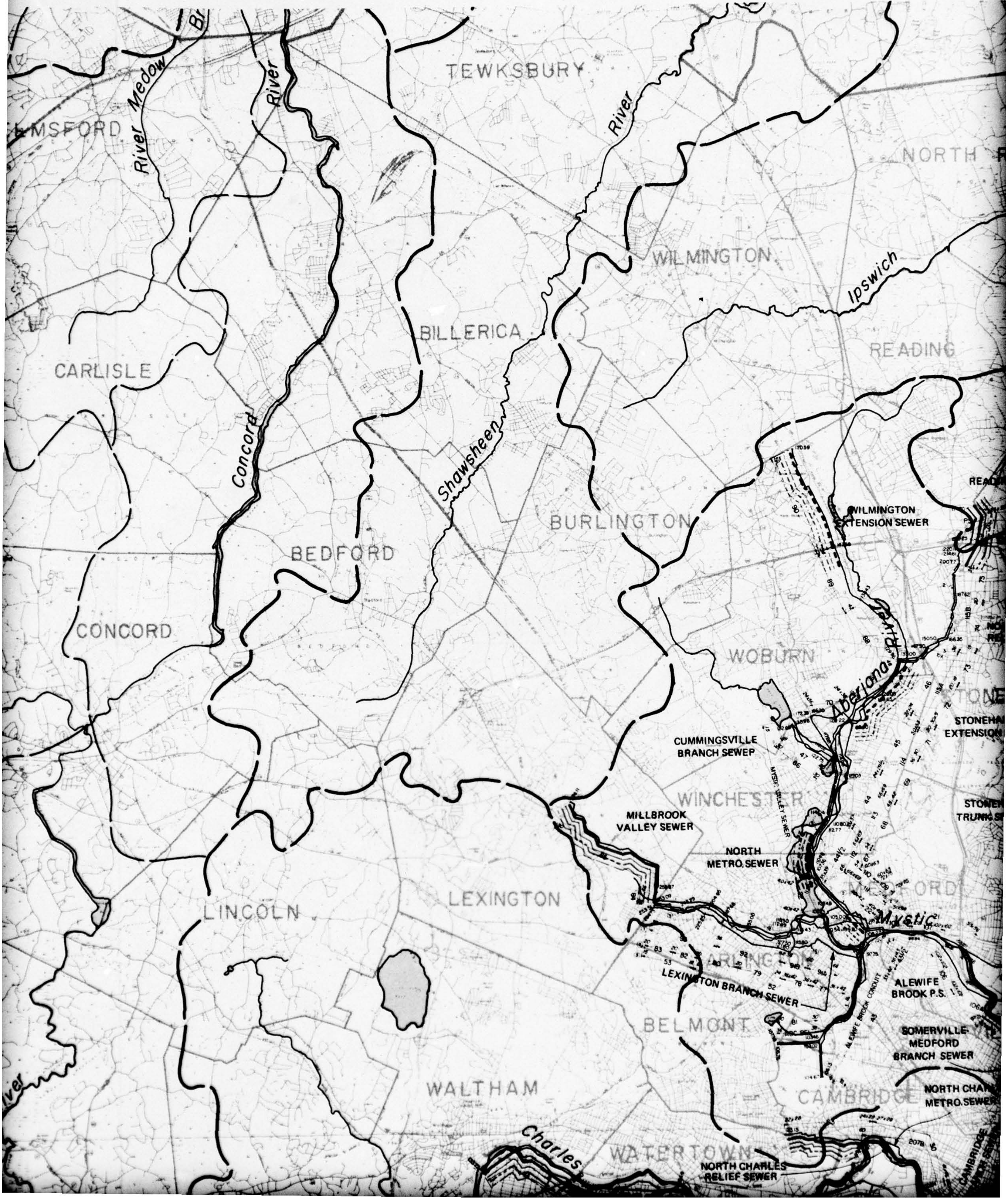
EXISTING MDC INTERCEPTOR S

OCTOBER, 1975

12



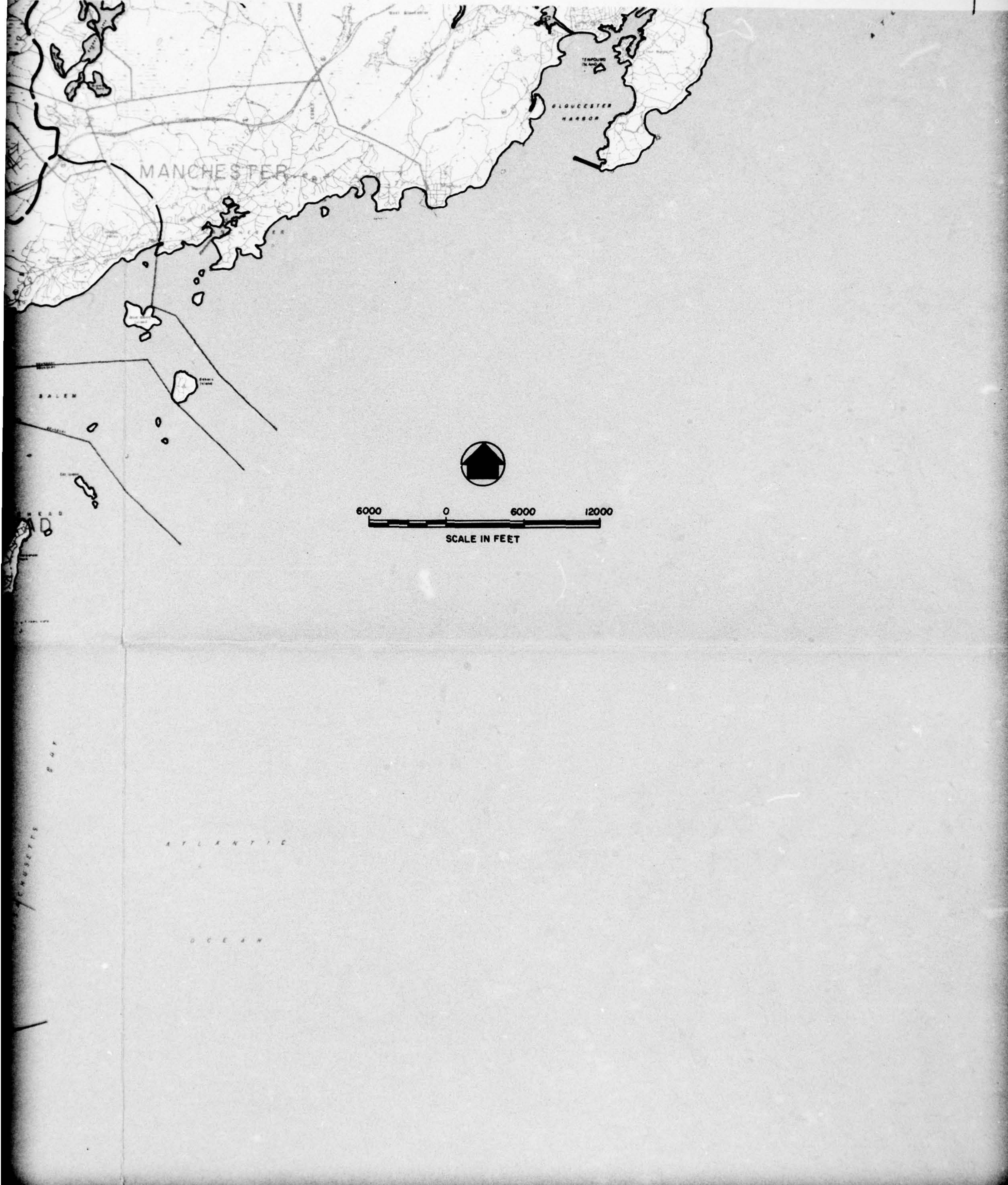
Stony
Brook
CHELMSFORD
River
Medow
WESTFORD
CARLISLE
LITTLETON
BOXBOROUGH
ACTON
CONCORD
River
Assabet
STOW
N
MAYNARD
HUDSON
River
River
SUDBURY



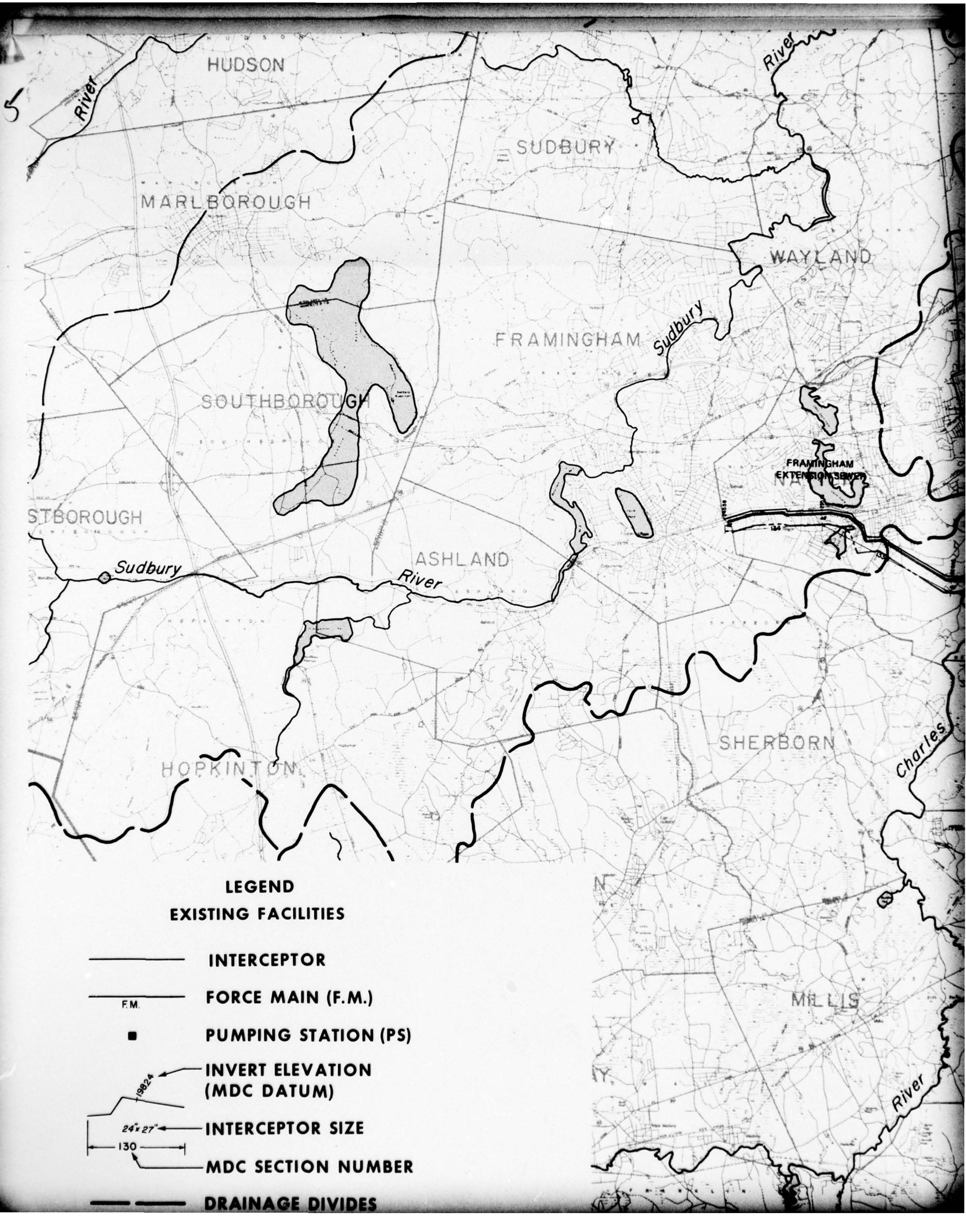
TEWKSBURY
River Medow
River
MSFORD
NORTH
River
WILMINGTON
Ipswich
BILLERICA
READING
CARLISLE
Concord
Shawsheen
BURLINGTON
WILMINGTON EXTENSION SEWER
BEDFORD
CONCORD
WOBURN
Aberjona River
CUMMINGSVILLE BRANCH SEWER
STONEHA EXTENSION
WINCHESTER
MILLBROOK VALLEY SEWER
NORTH METRO. SEWER
MEDFORD
LEXINGTON
LINCOLN
Mystic
ARLINGTON
LEXINGTON BRANCH SEWER
ALEWIFE BROOK P.S.
ALEWIFE BROOK CONDUIT
BELMONT
SOMERVILLE MEDFORD BRANCH SEWER
WALTHAM
CAMBRIDGE
NORTH CHA METRO. SEWER
Charles
WATERTOWN
NORTH CHARLES RELIEF SEWER

MIDDLETON
WENHAM
NORTH READING
DANVERS
Ipswich
River
READING
LYNNFIELD
PEABODY
READING P.S.
WILMINGTON EXTENSION SEWER
READING EXTENSION SEWER
WAKEFIELD
SALEM
Saugus
LYNN
NORTH METRO. RELIEF SEWER
SWAMPSCOTT
Aberjona River
STONEHAM EXTENSION SEWER
River
SAUGUS
WAKEFIELD BRANCH SEWER
WAKEFIELD BRANCH RELIEF SEWER
STONEHAM TRUNK SEWER
WAKEFIELD TRUNK SEWER
MALDEN RELIEF SEWER
NAHANT
Mystic
NORTH METRO. SEWER
REVERE
CHELSEA BRANCH SEWER
REVERE EXTENSION SEWER
ALEWIFE BROOK P.S.
CHELSEA CREEK HDWKS.
SOMERVILLE-MEDFORD BRANCH SEWER
EAST BOSTON STEAM P.S.
River
CHARLESTOWN P.S.
NORTH METRO SEWER
NORTH CHARLES METRO. SEWER
CAMBRIDGE
WINTHROP
EAST BOSTON ELECTRIC P.S.

4



MANCHESTER
GLOUCESTER
HARBOR
SALEM
6000 0 6000 12000
SCALE IN FEET
ATLANTIC
OCEAN


HUDSON
River
SUDBURY
MARLBOROUGH
WAYLAND
Sudbury
FRAMINGHAM
SOUTHBOROUGH
FRAMINGHAM EXTENSION SEWER
STBOROUGH
ASHLAND
Sudbury
River
SHERBORN
Charles
HOPKINTON
MILLIS
River
LEGEND
EXISTING FACILITIES
INTERCEPTOR
F.M.
FORCE MAIN (F.M.)
PUMPING STATION (PS)
19824
INVERT ELEVATION (MDC DATUM)
24"x 27"
INTERCEPTOR SIZE
130
MDC SECTION NUMBER
DRAINAGE DIVIDES

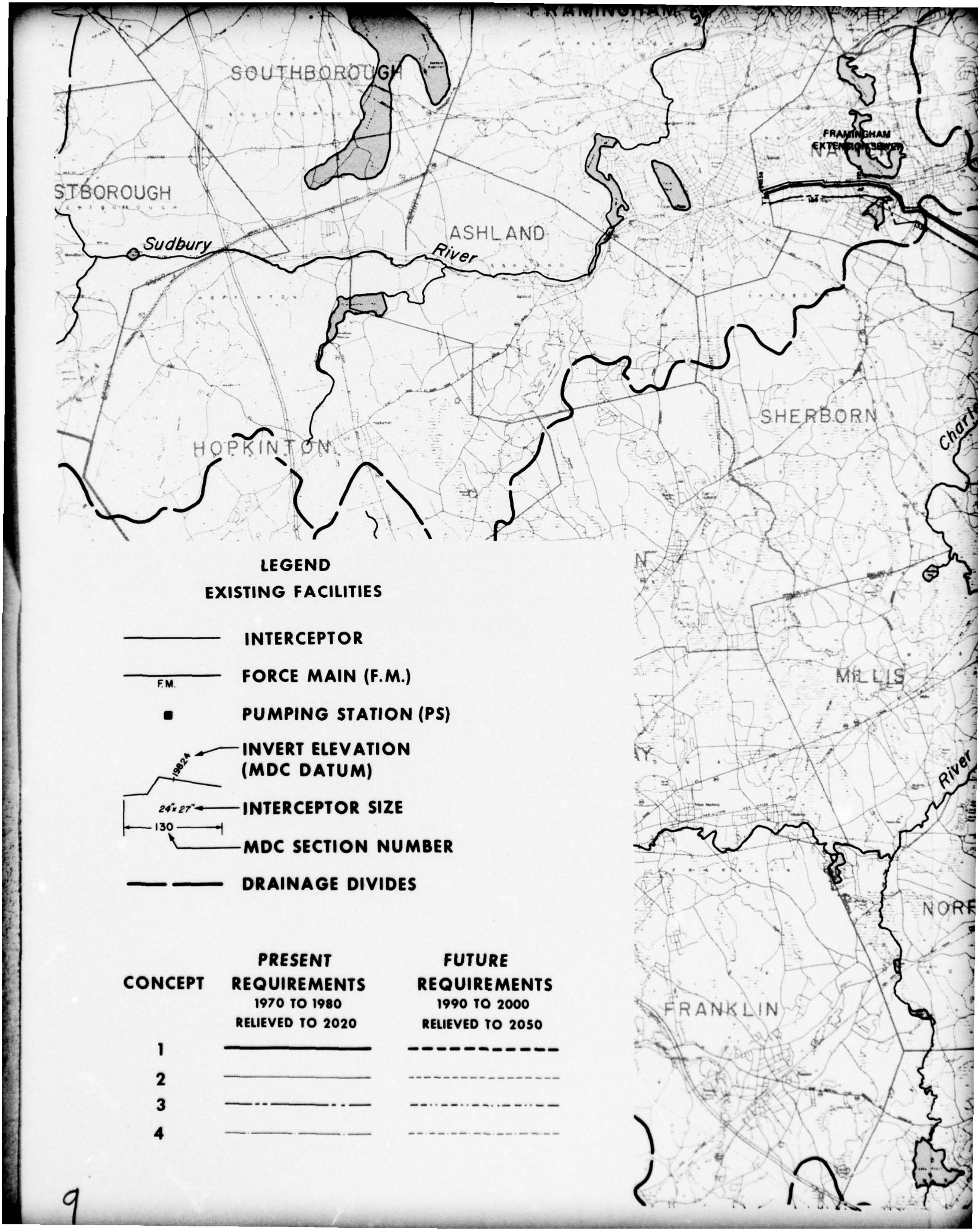

WALTHAM
CAMBRIDGE
NORTH CHARLES METRO.SEWER
CAMBRIDGE BRANCH SEWER
WATERTOWN
Charles
NORTH CHARLES RELIEF SEWER
WESTON
SOUTH CHARLES RELIEF SEWER
River
CHARLES RIVER
SOUTH CHARLES RELIEF SEWER
CHARLES RIVER VALLEY SEWER
BRIGHTON BRANCH SEWER
NEWTON
BROOKLINE
BOSTON
WELLESLEY
NEEDHAM
UPPER NEPONSET VALLEY SEWER
River
WELLESLEY EXTENSION RELIEF SEWER
WELLESLEY EXTENSION SEWER
WELLESLEY EXTENSION RELIEF SEWER
NEPONSET VALLEY SEWER
NEW NEPONSET VALLEY SEW
Charles
DOVER
Neponset
MILTON
WESTWOOD
WESTWOOD EXTENSION SEWER
MEDFIELD
NORWOOD
CANTON
WALPOLE
River
WALPOLE EXTENSION SEWER
STOUGHTON EXTENSION SEWER
River

7
NORTH METRO SEWER
WINTHROP
NORTH CHARLES METRO SEWER
CAMBRIDGE BRANCH SEWER
CHARLESTOWN BRANCH SEWER
EAST BOSTON ELECTRIC P.S.
NORTH METRO RELIEF TUNNEL
WINTHROP TERMINAL FACILITY
DEER ISLAND WWTP
River
CHARLES RIVER CROSSING
SOUTH CHARLES RELIEF SEWER
WARD STREET HEADWORKS
BOSTON MAIN DRAINAGE TUNNEL
COLUMBUS PARK HEADWORKS
CALF PASTURE P.S.
BOSTON
DORCHESTER INTERCEPTOR
SQUANTUM P.S.
HULL
NUT ISLAND WWTP.
HOUGHS NECK P.S.
River
QUINCY P.S.
BRAINTREE-WEYMOUTH P.S.
BRAINTREE-WEYMOUTH EXTENSION SEWER
HIGH LEVEL SEWER
HINGHAM P.S.
QUINCY
NEW NEPONSET VALLEY SEWER
HINGHAM F.M.
LOWER BRAINTREE CONNECTING SEWER
MILTON
Weymouth Fore River
Weymouth Back River
HINGHAM
BRAINTREE
BRAINTREE-RANDOLPH EXTENSION SEWER
WEYMOUTH
NORWELL
STOUGHTON EXTENSION SEWER
ROCKLAND


COHASSET
SCITUATE
COHASSET
SCITUATE
MASSACHUSETTS BAY
ORWELL
River
MARSHFIELD
HANOVER

8

FIG. 4-1



FRAMINGHAM
SOUTHBOROUGH
STBOROUGH
ASHLAND
Sudbury
River
FRAMINGHAM EXTENSION SEWER
SHERBORN
HOPKINTON
MILLIS
FRANKLIN
River
LEGEND
EXISTING FACILITIES
INTERCEPTOR
FORCE MAIN (F.M.)
F.M.
PUMPING STATION (PS)
INVERT ELEVATION (MDC DATUM)
198.24
INTERCEPTOR SIZE
24" x 27"
130
MDC SECTION NUMBER
DRAINAGE DIVIDES
CONCEPT
PRESENT REQUIREMENTS 1970 TO 1980 RELIEVED TO 2020
FUTURE REQUIREMENTS 1990 TO 2000 RELIEVED TO 2050
1
2
3
4

WELLESLEY
NEEDHAM
UPPER NEPONSET VALLEY SEWER
WELLESLEY EXTENSION RELIEF SEWER
River
WELLESLEY EXTENSION SEWER
WELLESLEY EXTENSION RELIEF SEWER
NEPONSET VALLEY SEWER
Charles
DOVER
WESTWOOD
WESTWOOD EXTENSION SEWER
Neponset
MEDFIELD
NORWOOD
CANTON
WALPOLE
River
WALPOLE EXTENSION SEWER
STOUGHTON EXTENSION SEWER
River
Neponset
NORFOLK
SHARON

CALF PASTURE P.S.
BOSTON
DORCHESTER INTERCEPTOR
SQUANTUM P.S.
HULL
NUT ISLAND WWTP
HOUGHS NECK P.S.
QUINCY BAY
River
EXTENSION SEWER
QUINCY P.S.
F.M.
BRAINTREE-WEYMOUTH P.S.
BRAINTREE-WEYMOUTH EXTENSION SEWER
HIGH LEVEL SEWER
HINGHAM P.S.
QUINCY
NEW NEPONSET VALLEY SEWER
HINGHAM F.M.
LOWER BRAINTREE CONNECTING SEWER
MILTON
Weymouth Fore River
Weymouth Back River
HINGHAM
BRAINTREE
BRAINTREE-RANDOLPH EXTENSION SEWER
WEYMOUTH
NORWE
STOUGHTON EXTENSION SEWER
ROCKLAND
HANO
STOUGHTON

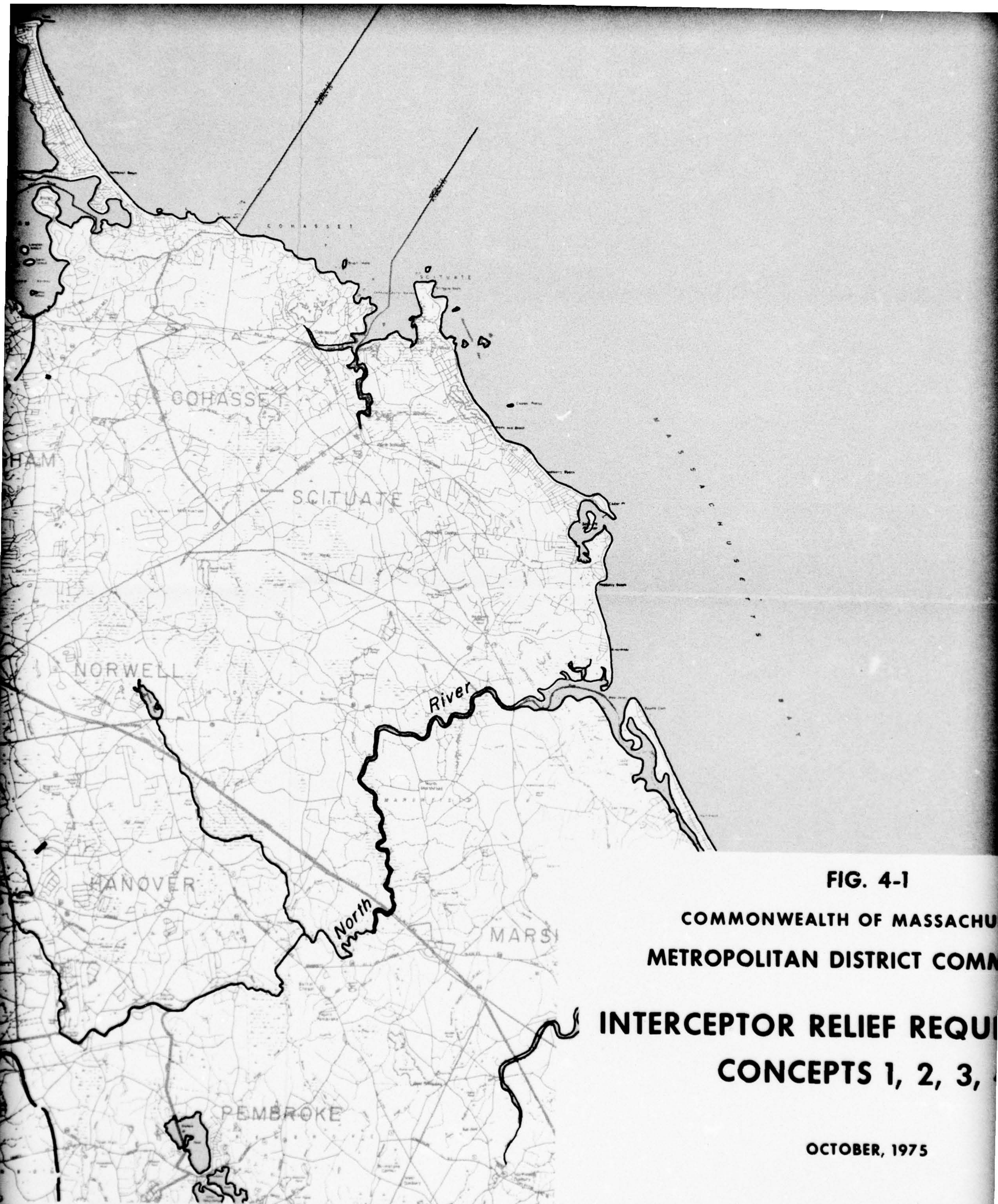


FIG. 4-1

COMMONWEALTH OF MASSACHU

METROPOLITAN DISTRICT COMM

INTERCEPTOR RELIEF REQU

CONCEPTS 1, 2, 3,

OCTOBER, 1975

12

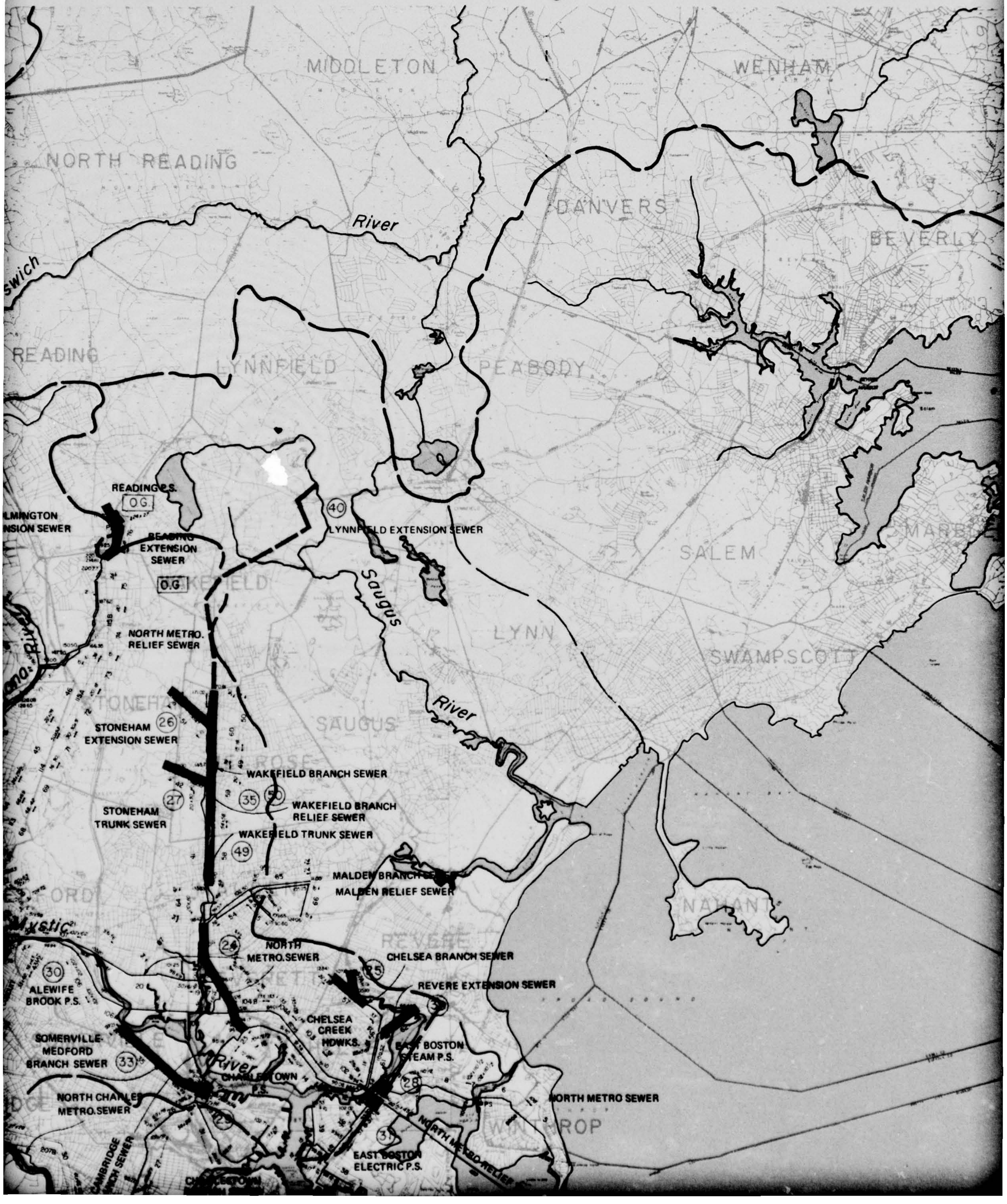
1

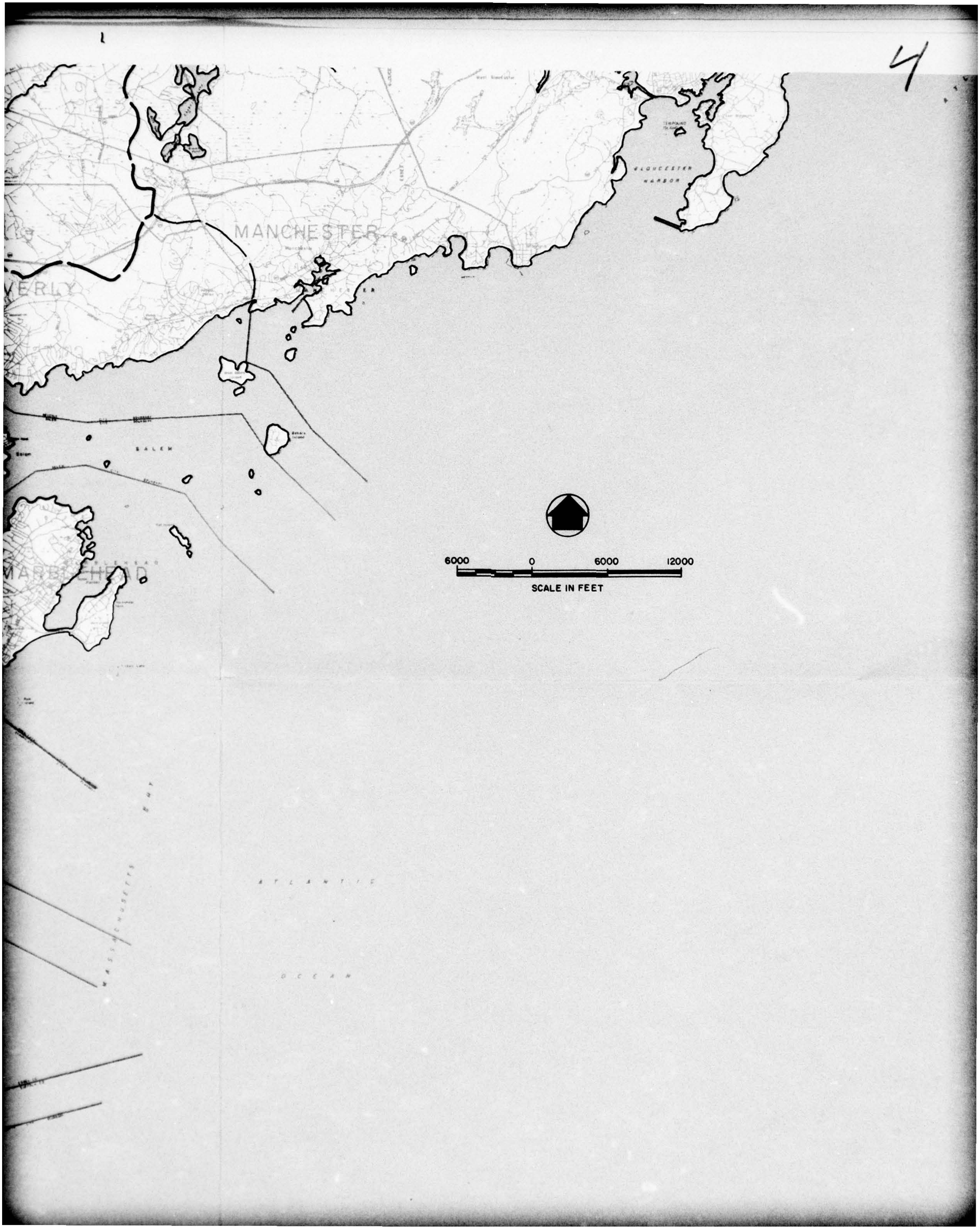
Stony
Brook
River
Meadow
CHELMSFORD
WESTFORD
CARLISLE
LITTLETON
BOXBOROUGH
ACTON
CONCORD
Assabet
River
N
STOW
MAYNARD
HUDSON
River
River

2

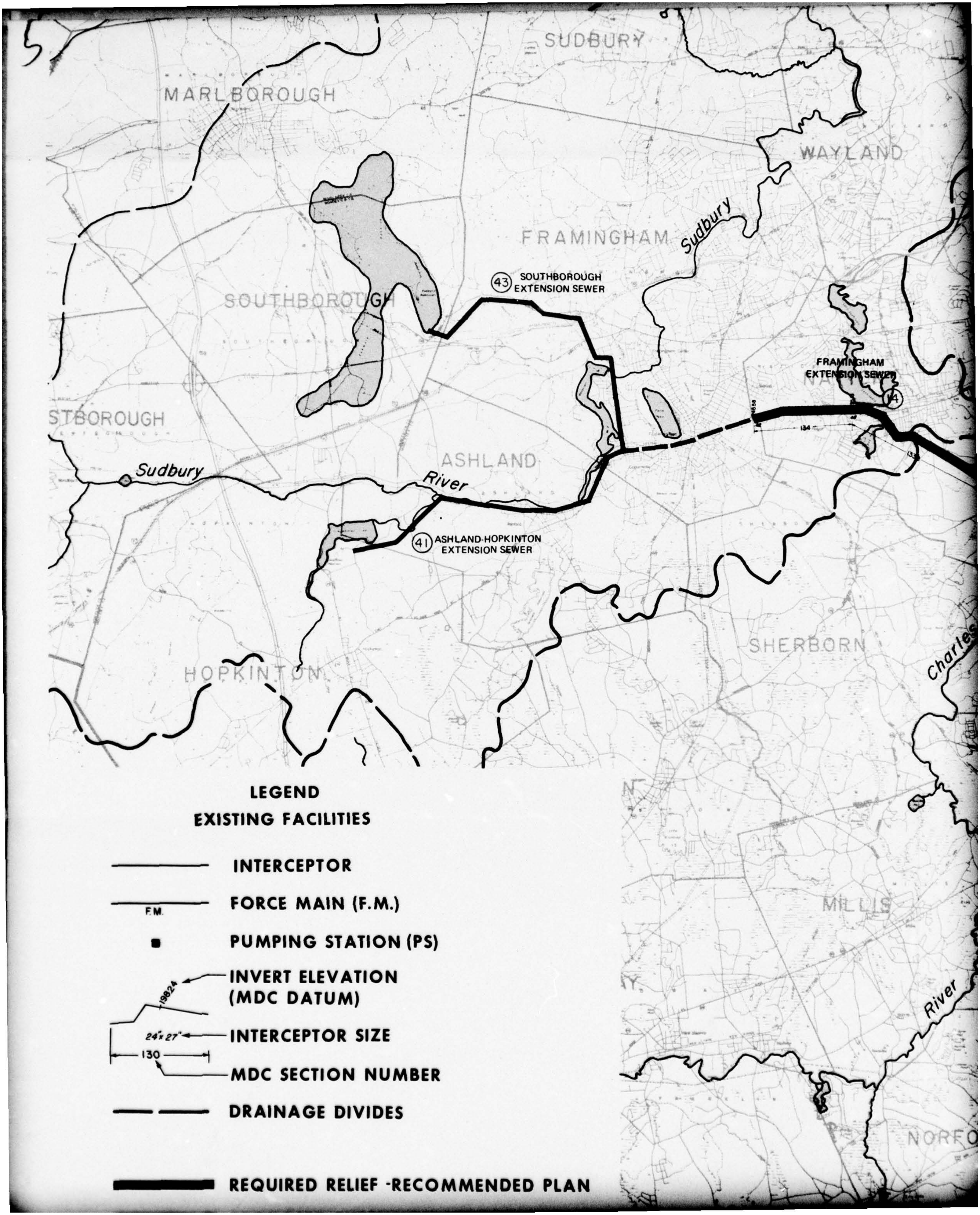

TEWKSBURY
River Medow
River
Concord
Shawsheen
River
NORTH
WILMINGTON
Ipswich
CARLISLE
BILLERICA
READING
BEDFORD
BURLINGTON
WILMINGTON EXTENSION SEWER
CONCORD
WOBURN
Aberjona River
CUMMINGSVILLE BRANCH SEWER
STONEHAM EXTENSION
WINCHESTER
MILLBROOK VALLEY SEWER
NORTH METRO. SEWER
LINCOLN
LEXINGTON
Mystic
ARLINGTON
LEXINGTON BRANCH SEWER
ALEWIFE BROOK P.S.
BELMONT
ALEWIFE BROOK CONDUIT
SOMERVILLE-MEDFORD BRANCH SEWER
WESTON-LINCOLN EXTENSION SEWER
WALTHAM
CAMBRIDGE
NORTH CHARLES METRO. SEWER
Charles
WATERTOWN
NORTH CHARLES RELIEF SEWER
CAMBRIDGE BRANCH SEWER
46
37
22
47
30
42
33
21
34

3


MIDDLETON
WENHAM
NORTH READING
River
DANVERS
BEVERLY
READING
LYNNFIELD
PEABODY
READING P.S.
O.G.
40
LYNNFIELD EXTENSION SEWER
READING EXTENSION SEWER
SALEM
Saugus
LYNN
NORTH METRO. RELIEF SEWER
SWAMPSCOTT
River
SAUGUS
26
STONEHAM EXTENSION SEWER
WAKEFIELD BRANCH SEWER
27
35
50
WAKEFIELD BRANCH RELIEF SEWER
STONEHAM TRUNK SEWER
WAKEFIELD TRUNK SEWER
49
MALDEN BRANCH SEWER
MALDEN RELIEF SEWER
NAHANT
Mystic
REVERE
24
NORTH METRO.SEWER
CHELSEA BRANCH SEWER
25
30
ALEWIFE BROOK P.S.
REVERE EXTENSION SEWER
CHELSEA CREEK HDWKS.
SOMERVILLE-MEDFORD BRANCH SEWER
33
EAST BOSTON STEAM P.S.
River
CHARLESTOWN P.S.
28
NORTH METRO SEWER
NORTH CHARLES METRO.SEWER
WINTHROP
31
EAST BOSTON ELECTRIC P.S.
CAMBRIDGE BRANCH SEWER



4
MANCHESTER
VERLY
GLOUCESTER HARBOR
SALEM
MARBLEHEAD
6000
0
6000
12000
SCALE IN FEET
ATLANTIC
OCEAN
MASSACHUSETTS BAY



SUDBURY
MARLBOROUGH
WAYLAND
FRAMINGHAM
Sudbury
SOUTHBOROUGH
43 SOUTHBOROUGH EXTENSION SEWER
FRAMINGHAM EXTENSION SEWER
14
STBOROUGH
ASHLAND
Sudbury
River
41 ASHLAND-HOPKINTON EXTENSION SEWER
134
133
SHERBORN
Charles
HOPKINTON
MILLIS
River
NORFO
LEGEND
EXISTING FACILITIES
INTERCEPTOR
F.M.
FORCE MAIN (F.M.)
PUMPING STATION (PS)
19824
INVERT ELEVATION (MDC DATUM)
24"x 27"
INTERCEPTOR SIZE
130
MDC SECTION NUMBER
DRAINAGE DIVIDES
REQUIRED RELIEF -RECOMMENDED PLAN

WATERTOWN
NORTH CHARLES RELIEF SEWER
SOUTH CHARLES RELIEF SEWER
WESTON
CHARLES RIVER VALLEY SEWER
WAYLAND
NEWTON
BRIGHTON BRANCH SEWER
BROOKLINE
WELLESLEY
FRAMINGHAM EXTENSION SEWER
NEEDHAM
O.G.
UPPER NEPONSET VALLEY SEWER
MIDDLE CHARLES WWTP
River
WELLESLEY EXTENSION RELIEF SEWER
WELLESLEY EXTENSION SEWER
WELLESLEY EXTENSION RELIEF SEWER
NEPONSET VALLEY SEWER
Neponset
SHERBORN
Charles
DOVER
WESTWOOD
WESTWOOD EXTENSION SEWER
MEDFIELD
NORWOOD
CANTON
MILLIS
WALPOLE
River
UPPER NEPONSET WWTP
WALPOLE EXTENSION SEWER
River
SHARON EXTENSION SEWER
Neponset
NORFOLK
SHARON

NORTH CHARLES RELIEF SEWER
CAMBRIDGE BRANCH SEWER
CHARLESTOWN BRANCH SEWER
ELECTRIC P.S.
RELIEF TUNNEL
WINTHROP TERMINAL FACILITY
DEER ISLAND WWTP
1 6 8 9
River
CHARLES RIVER CROSSING
SOUTH CHARLES RELIEF SEWER
36 52
WARD STREET HEADWORKS
BRIGHTON BRANCH SEWER
BOSTON MAIN DRAINAGE TUNNEL
BMDR
COLUMBUS PARK HEADWORKS
BROOKLINE
CALF PASTURE P.S.
BOSTON
DORCHESTER INTERCEPTOR
SQUANTUM P.S.
O.G.
HULL
NUT ISLAND WWTP
5 7
HOUGHS NECK P.S.
32
UPPER NEPONSET VALLEY SEWER
O.G.
River
23
QUINCY P.S.
WEYMOUTH
WELLESLEY EXTENSION RELIEF SEWER
17
BRAINTREE-WEYMOUTH P.S.
BRAINTREE-WEYMOUTH EXTENSION SEWER
O.G.
HIGH LEVEL SEWER
38
HINGHAM P.S.
QUINCY
18
HINGHAM F.M.
16
LOWER BRAINTREE CONNECTING SEWER
NEW NEPONSET VALLEY SEWER
NEPONSET VALLEY SEWER
Neponset
MILTON
Weymouth Fore River
Weymouth Back River
BRAINTREE
BRAINTREE-RANDOLPH EXTENSION SEWER
WEYMOUTH
CANTON
11
UPPER NEPONSET WWTP
19 45
STOUGHTON EXTENSION SEWER
ROCKLAND
44
SHARON EXTENSION SEWER
STOUGHTON

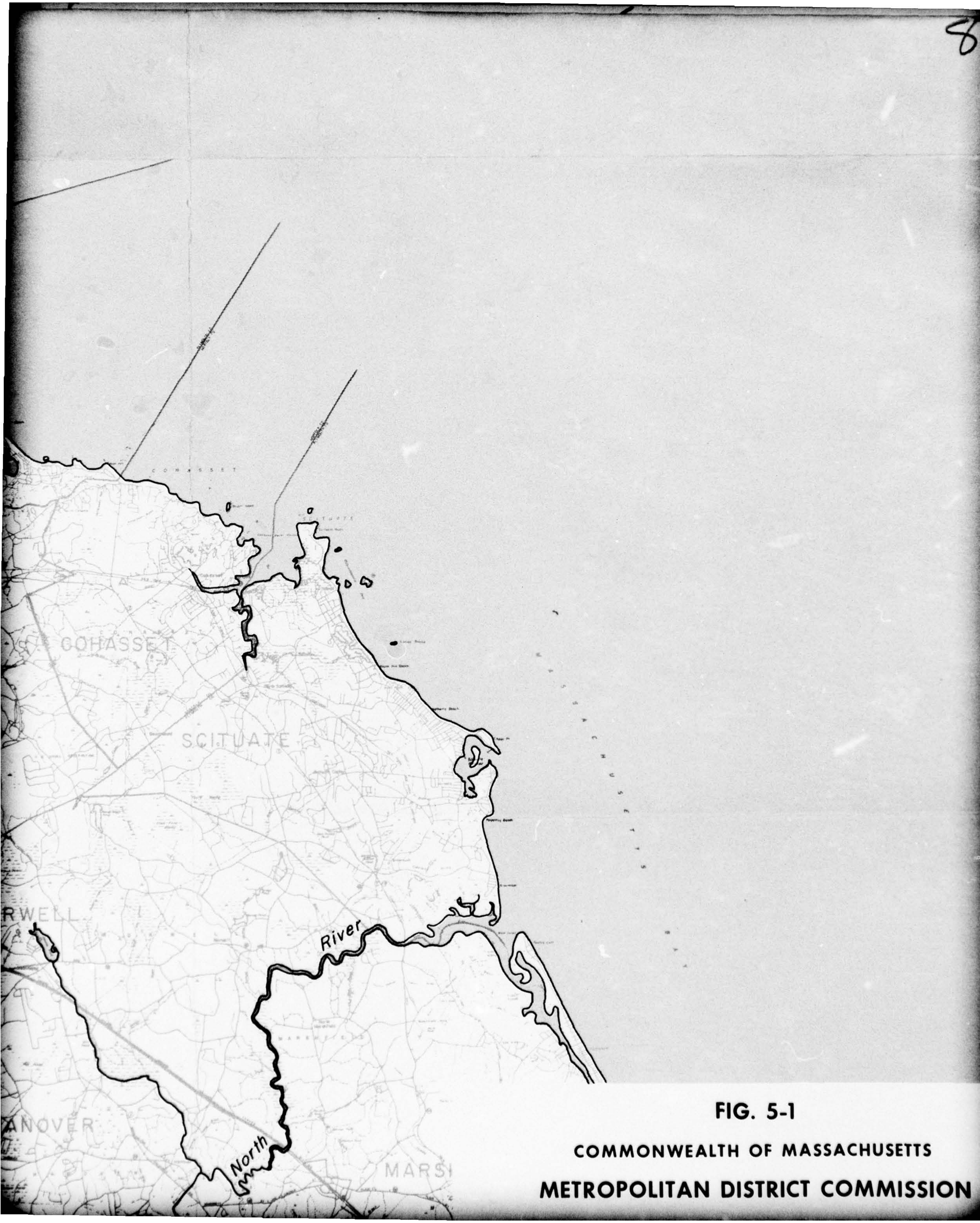
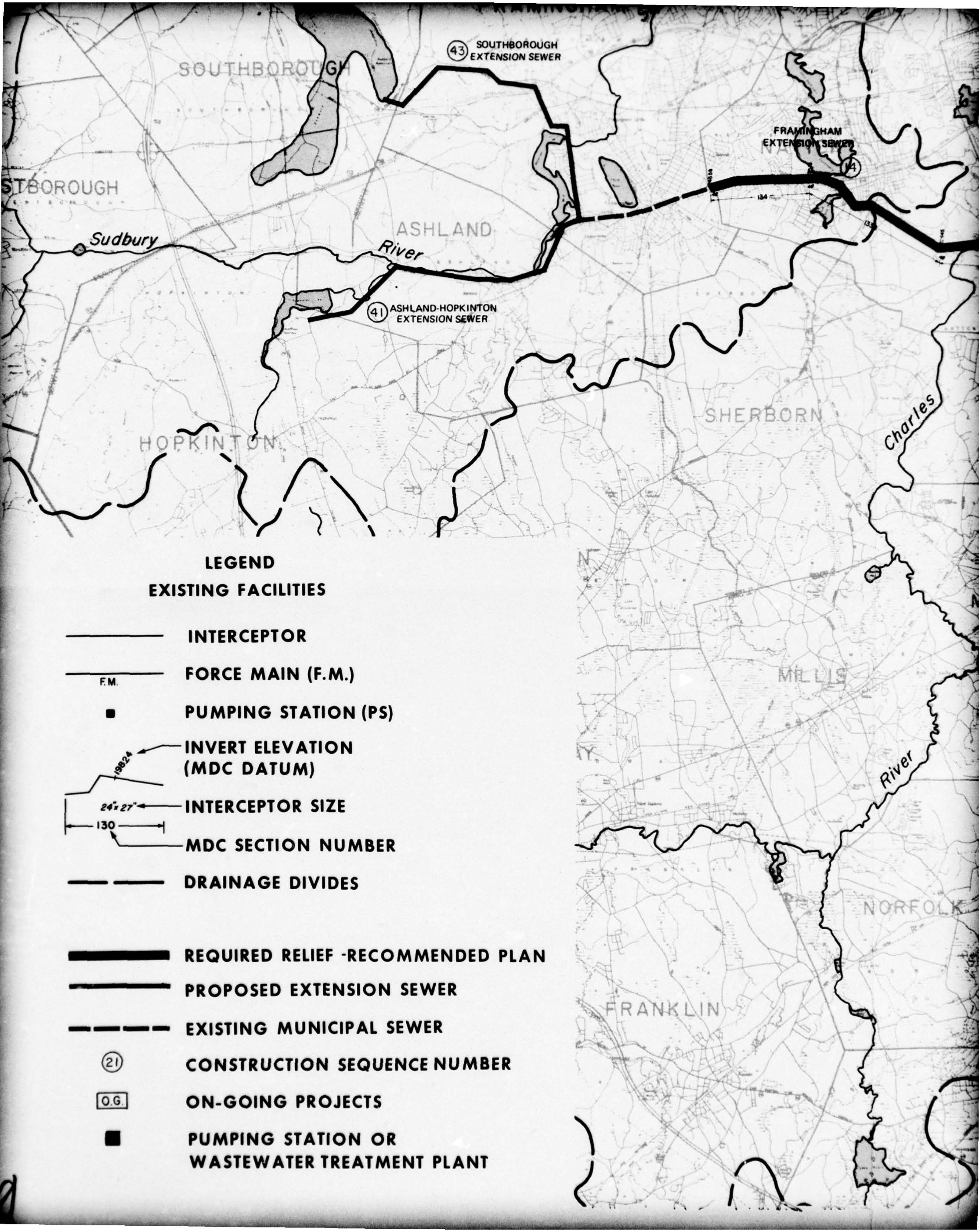


FIG. 5-1

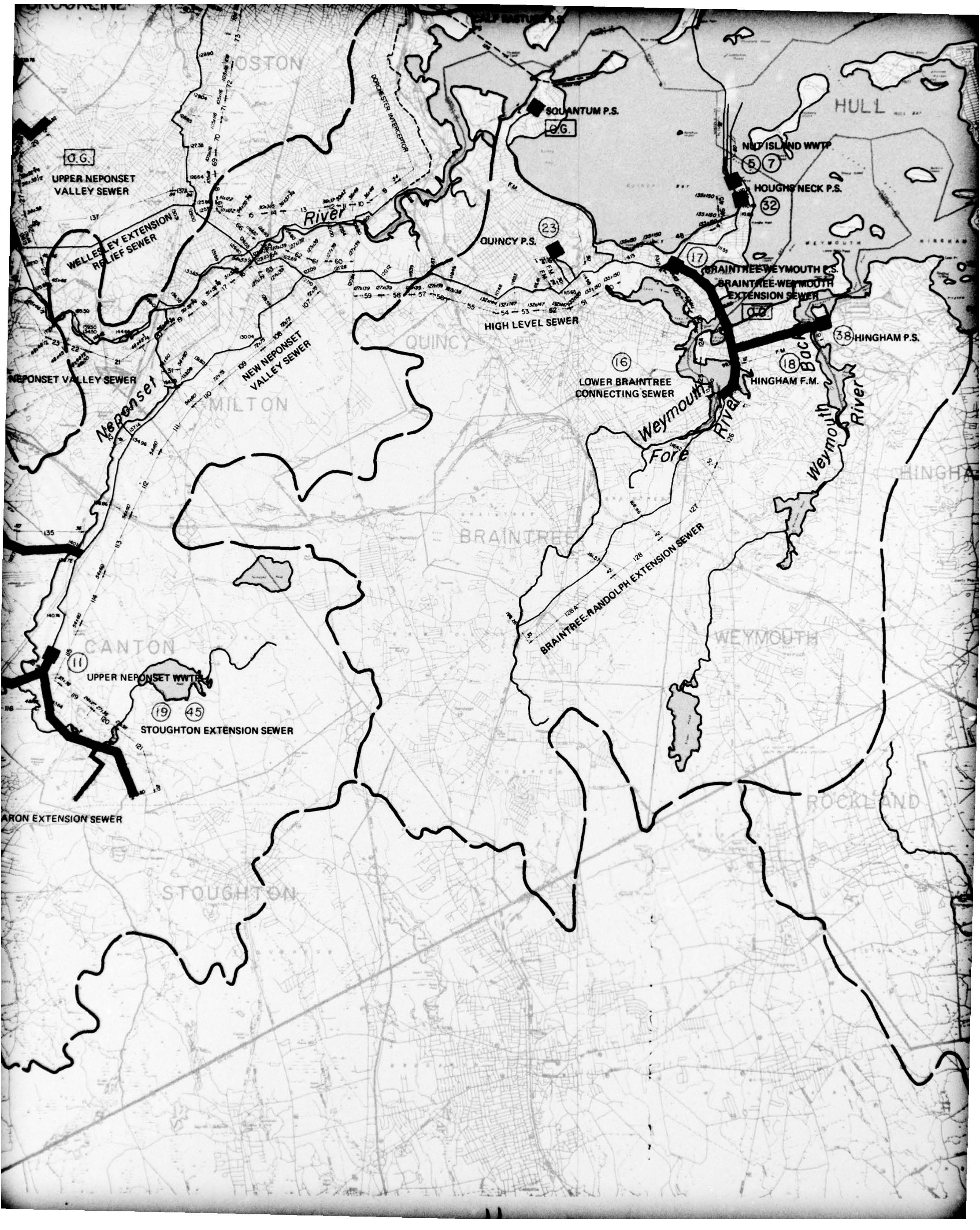
COMMONWEALTH OF MASSACHUSETTS

METROPOLITAN DISTRICT COMMISSION



SOUTHBOROUGH
43 SOUTHBOROUGH EXTENSION SEWER
FRAMINGHAM EXTENSION SEWER
14
TBOROUGH
ASHLAND
Sudbury
River
41 ASHLAND-HOPKINTON EXTENSION SEWER
134
SHERBORN
Charles
River
HOPKINTON
MILLIS
NORFOLK
FRANKLIN
LEGEND
EXISTING FACILITIES
INTERCEPTOR
F.M.
FORCE MAIN (F.M.)
PUMPING STATION (PS)
19824
INVERT ELEVATION (MDC DATUM)
24" x 27"
INTERCEPTOR SIZE
130
MDC SECTION NUMBER
DRAINAGE DIVIDES
REQUIRED RELIEF -RECOMMENDED PLAN
PROPOSED EXTENSION SEWER
EXISTING MUNICIPAL SEWER
21
CONSTRUCTION SEQUENCE NUMBER
O.G.
ON-GOING PROJECTS
PUMPING STATION OR WASTEWATER TREATMENT PLANT

BROOKLINE
WELLESLEY
FRAMINGHAM EXTENSION SEWER
14
NEEDHAM
O.G.
UPPER NEPONSET VALLEY SEWER
MIDDLE CHARLES WWTP
10
River
WELLESLEY EXTENSION RELIEF SEWER
WELLESLEY EXTENSION SEWER
WELLESLEY EXTENSION RELIEF SEWER
NEPONSET VALLEY SEWER
Neponset
SHERBORN
Charles
DOVER
WESTWOOD
WESTWOOD EXTENSION SEWER
48
MEDFIELD
NORWOOD
CANTON
11
MILLIS
WALPOLE
River
UPPER NEPONSET WWTP
20
WALPOLE EXTENSION SEWER
19
45
STOUGHTON
River
44
SHARON EXTENSION SEWER
Neponset
NORFOLK
SHARON



BOSTON
SQUANTUM P.S.
O.G.
HULL
NUT ISLAND WWTP
5 7
HOUGHS NECK P.S.
32
DORCHESTER INTERCEPTOR
O.G.
UPPER NEPONSET VALLEY SEWER
WELLESLEY EXTENSION RELIEF SEWER
River
QUINCY P.S.
23
17
BRAINTREE-WEYMOUTH P.S.
BRAINTREE-WEYMOUTH EXTENSION SEWER
O.G.
HIGH LEVEL SEWER
QUINCY
38 HINGHAM P.S.
18
16
LOWER BRAINTREE CONNECTING SEWER
HINGHAM F.M.
NEW NEPONSET VALLEY SEWER
NEPONSET VALLEY SEWER
Neponset
MILTON
Weymouth Fore River
Back River
Weymouth
BRAINTREE
BRAINTREE-RANDOLPH EXTENSION SEWER
CANTON
11
UPPER NEPONSET WWTP
19 45
STOUGHTON EXTENSION SEWER
WEYMOUTH
ROCKLAND
ARON EXTENSION SEWER
STOUGHTON

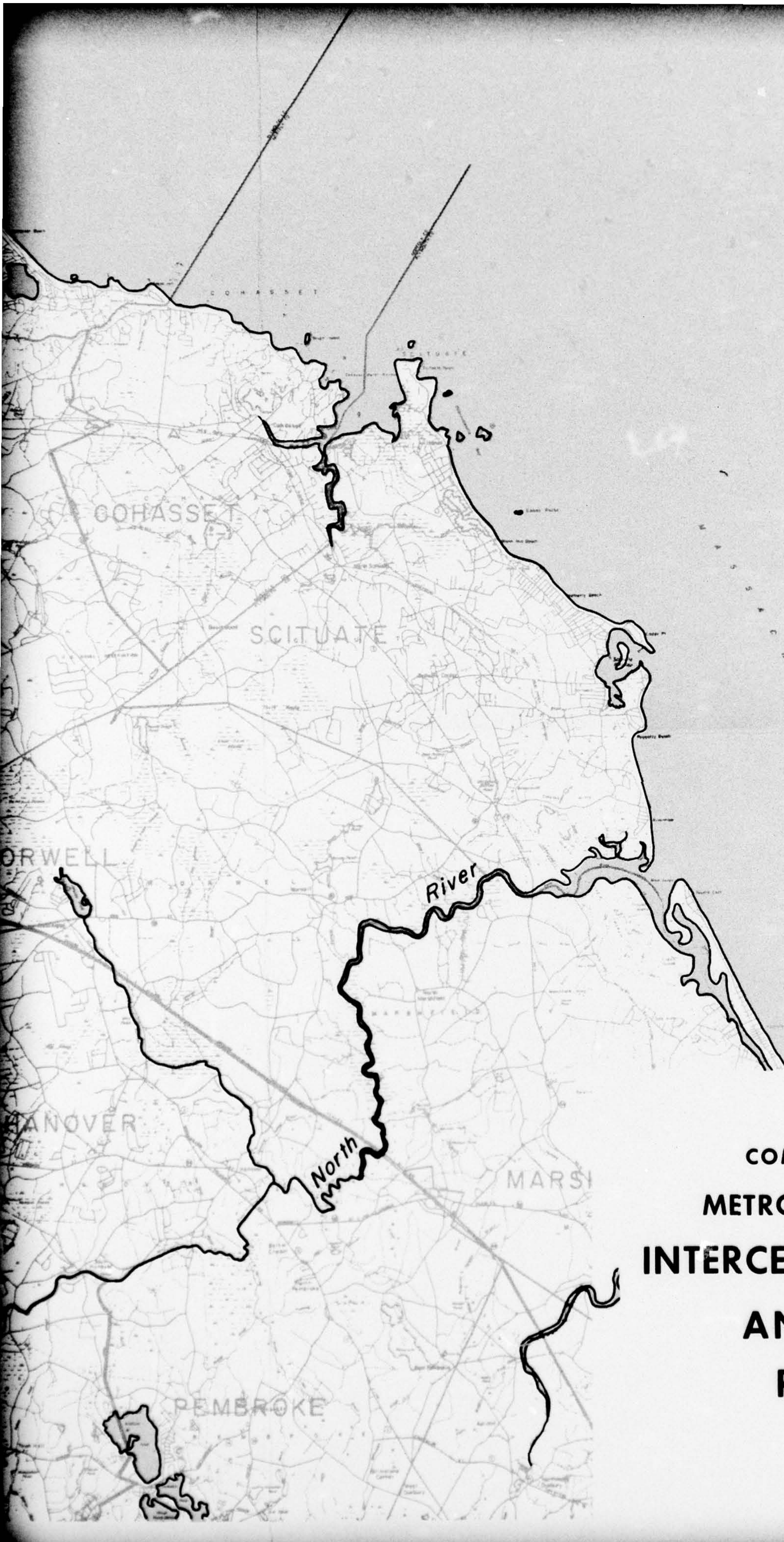


FIG. 5-1

COMMONWEALTH OF MASSACHUSETTS

METROPOLITAN DISTRICT COMMISSION

INTERCEPTOR RELIEF REQUIREMEN

AND EXTENSION SEWERS

RECOMMENDED PLAN

OCTOBER, 1975

12

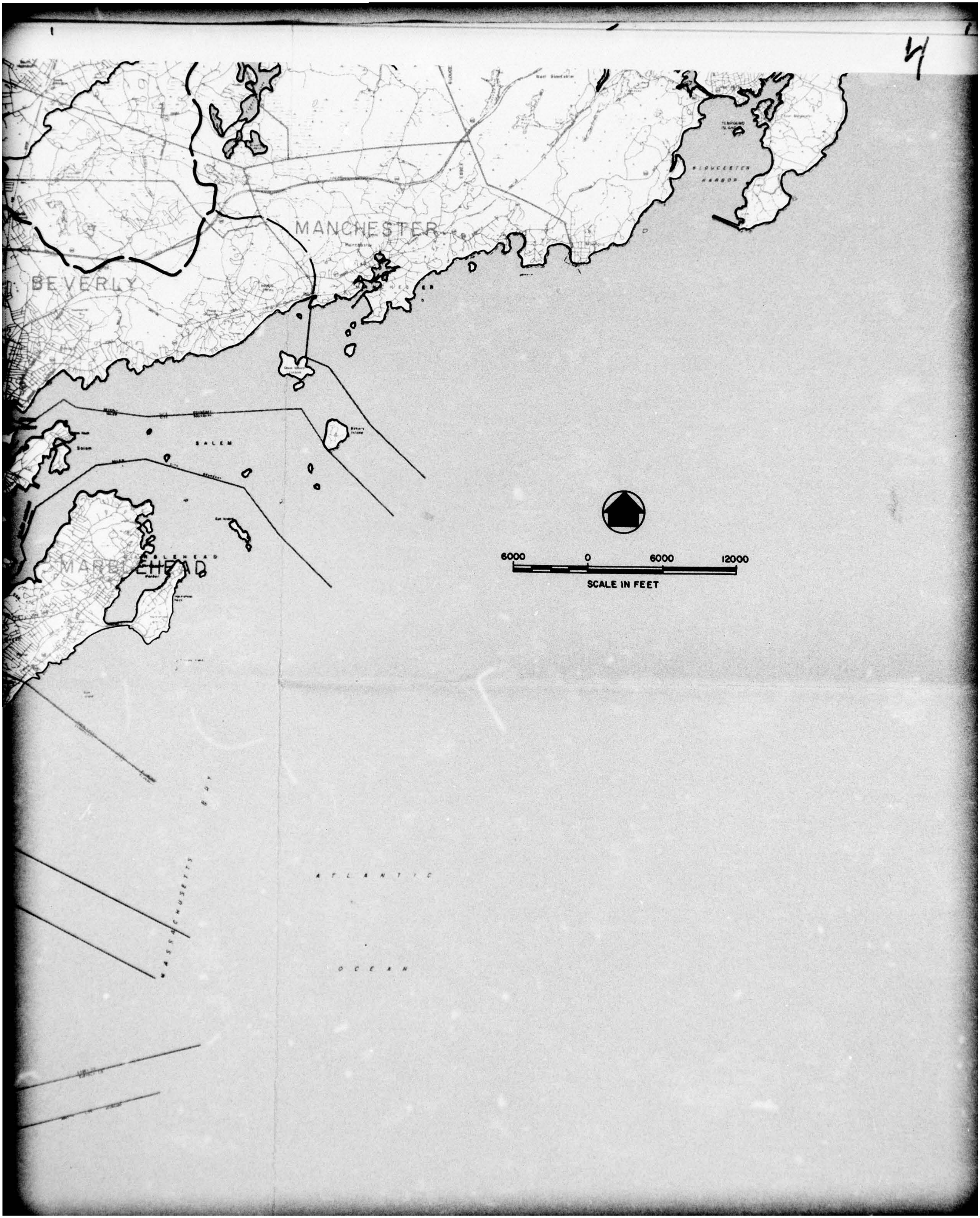
Stony
Brook
CHELMSFORD
River
WESTFORD
CARLISLE
LITTLETON
BOXBOROUGH
ACTON
CONCORD
N
STOW
Assabet
River
MAYNARD
HUDSON
River
River

2


TEWKSBURY
CHELMSFORD
River Medow
River
River
WILMINGTON
Ipswich
BILLERICA
READING
CARLISLE
Concord
Shawsheen
BURLINGTON
WILMINGTON EXTENSION SEWER
BEDFORD
CONCORD
WOBURN
Aberjona River
CUMMINGSVILLE BRANCH SEWER
WINCHESTER
MILLBROOK VALLEY SEWER
NORTH METRO.SEWER
LEXINGTON
LINCOLN
Mystic
ALEWIFE BROOK P.S.
BELMONT
WALTHAM
CAMBRIDGE
River
Charles
WATERTOWN
NORTH CHARLES RELIEF SEWER

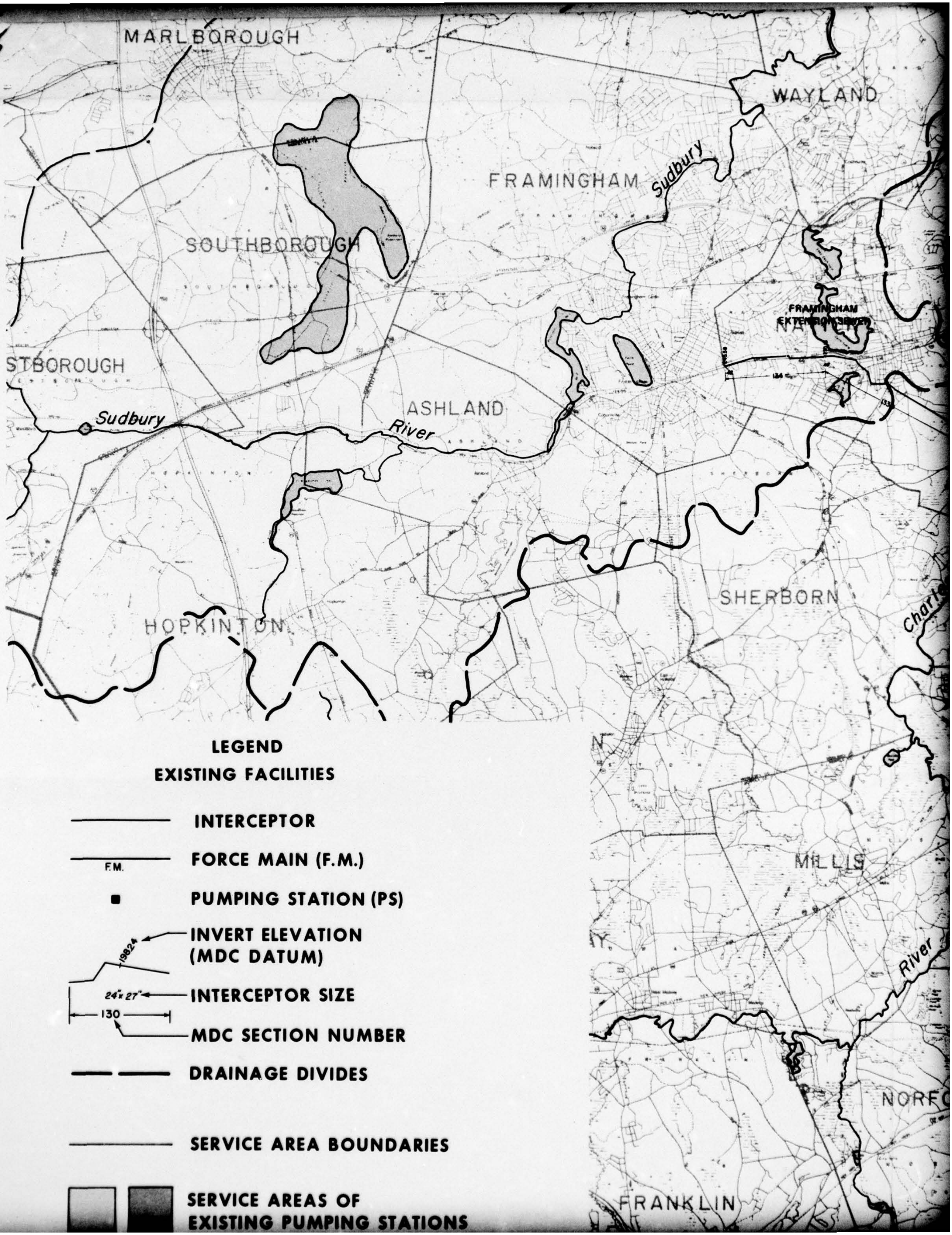
3


MIDDLETON
WENHAM
NORTH READING
DANVERS
River
Ipswich
READING
LYNNFIELD
PEABODY
READING P.S.
WILMINGTON EXTENSION SEWER
READING EXTENSION SEWER
WAKEFIELD
Saugus
SALEM
LYNN
NORTH METRO. RELIEF SEWER
SWAMPSCOTT
Aberjona River
STONEHAM
SAUGUS
River
STONEHAM EXTENSION SEWER
WAKEFIELD BRANCH SEWER
WAKEFIELD BRANCH RELIEF SEWER
STONEHAM TRUNK SEWER
WAKEFIELD TRUNK SEWER
MALDEN BRANCH SEWER
MALDEN RELIEF SEWER
MEDFORD
NAHANT
Mystic
REVERE
NORTH METRO SEWER
CHELSEA BRANCH SEWER
REVERE EXTENSION SEWER
ALEWIFE BROOK P.S.
CHELSEA CREEK HDWKS.
MEDFORD BRANCH SEWER
River
CHARLESTOWN
CAMBRIDGE
NORTH CHARLES METRO SEWER
NORTH METRO SEWER
WINTHROP



4
MANCHESTER
BEVERLY
MARBLEHEAD
SALEM
GLOUCESTER HARBOR
6000 0 6000 12000
SCALE IN FEET
MASSACHUSETTS BAY
ATLANTIC
OCEAN

5



MARLBOROUGH
WAYLAND
FRAMINGHAM
Sudbury
SOUTHBOROUGH
FRAMINGHAM
STBOROUGH
ASHLAND
Sudbury
River
SHERBORN
HOPKINTON
MILLIS
River
FRANKLIN
LEGEND
EXISTING FACILITIES
INTERCEPTOR
F.M.
FORCE MAIN (F.M.)
PUMPING STATION (PS)
198.24
INVERT ELEVATION (MDC DATUM)
24"x 27"
INTERCEPTOR SIZE
130
MDC SECTION NUMBER
DRAINAGE DIVIDES
SERVICE AREA BOUNDARIES
SERVICE AREAS OF EXISTING PUMPING STATIONS

RELIEF SEWER
CHARLES RIVER
VALLEY SEWER
BRIGHTON BRANCH SEWER
WAYLAND
NEWTON
BROOKLINE
WELLESLEY
FRAMINGHAM
EXTENSION SEWER
NEEDHAM
UPPER NEPONSET
VALLEY SEWER
River
WELLESLEY EXTENSION
RELIEF SEWER
WELLESLEY EXTENSION SEWER
WELLESLEY EXTENSION RELIEF SEWER
NEPONSET VALLEY SEWER
Charles
DOVER
WESTWOOD
WESTWOOD
EXTENSION SEWER
Neponset
MILTON
MEDFIELD
NORWOOD
CANTON
MILLIS
WALPOLE
River
WALPOLE EXTENSION SEWER
STOUGHTON EXTENSION SEWER
River
Neponset
NORFOLK
SHARON


7
DEER ISLAND WWTP
CHARLES RIVER CROSSING
SOUTH CHARLES RELIEF SEWER
WARD STREET HEADWORKS
BRIGHTON BRANCH SEWER
BOSTON MAIN DRAINAGE TUNNEL
COLUMBUS PARK HEADWORKS
BROOKLINE
CALF PASTURE P.S.
BOSTON
DORCHESTER INTERCEPTOR
SQUANTUM P.S.
HULL
NUT ISLAND WWTP.
UPPER NEPONSET VALLEY SEWER
HOUGHS NECK P.S.
River
WELLESLEY EXTENSION RELIEF SEWER
QUINCY P.S.
BRAINTREE-WEYMOUTH P.S.
BRAINTREE-WEYMOUTH EXTENSION SEWER
HIGH LEVEL SEWER
QUINCY
HINGHAM P.S.
NEW NEPONSET VALLEY SEWER
NEPONSET VALLEY SEWER
LOWER BRAINTREE CONNECTING SEWER
HINGHAM F.M.
Back
MILTON
Weymouth
Fore
River
Neponset
Weymouth
River
HINGHAM
BRAINTREE
BRAINTREE-RANDOLPH EXTENSION SEWER
WEYMOUTH
CANTON
STOUGHTON EXTENSION SEWER
ROCKLAND
STOUGHTON

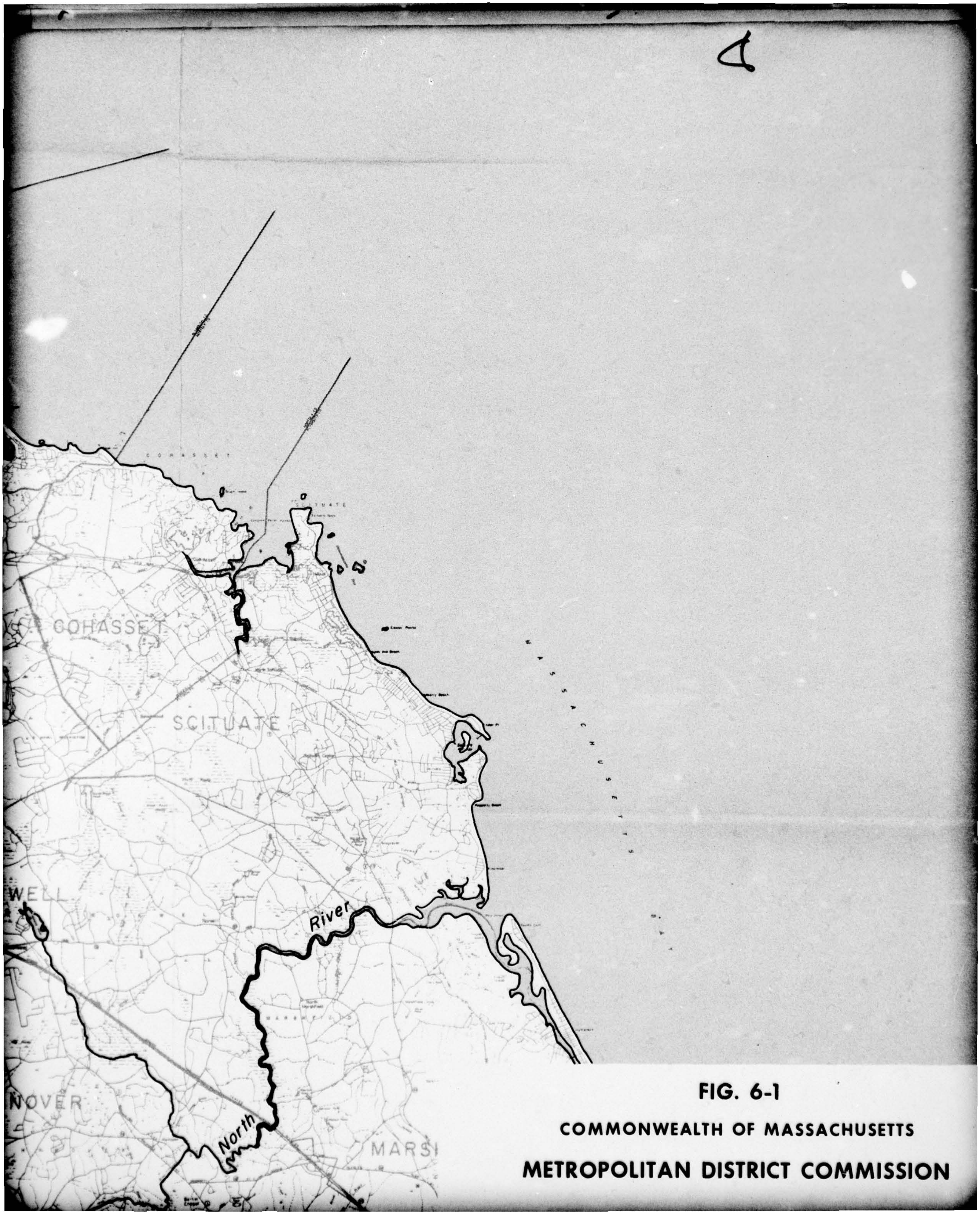
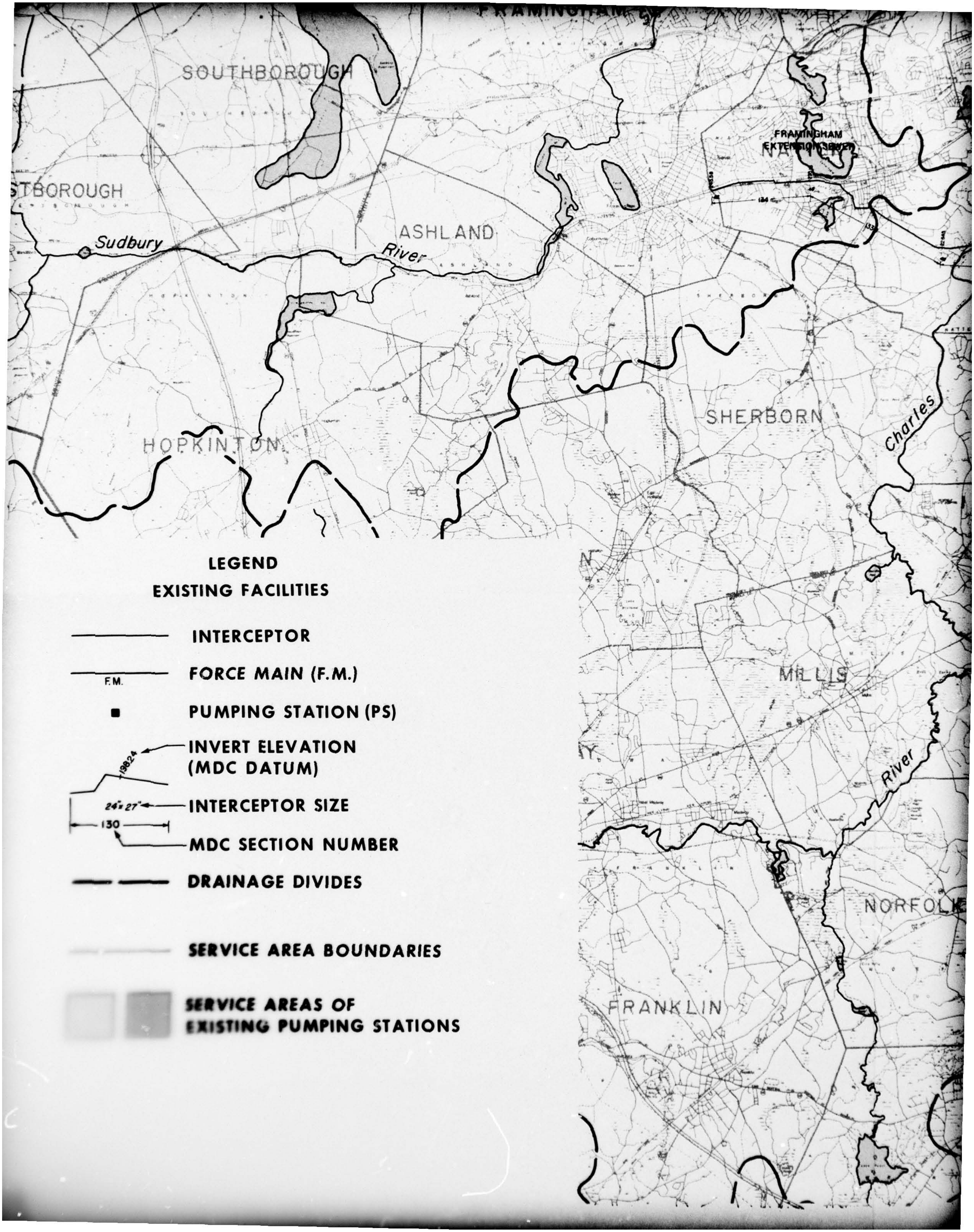


FIG. 6-1

COMMONWEALTH OF MASSACHUSETTS

METROPOLITAN DISTRICT COMMISSION


FRAMINGHAM
SOUTHBOROUGH
STBOROUGH
Sudbury
River
ASHLAND
FRAMINGHAM EXTENSION SEWER
NATICK
HOPKINTON
SHERBORN
Charles
River
MILLIS
NORFOLK
FRANKLIN
LEGEND
EXISTING FACILITIES
INTERCEPTOR
FORCE MAIN (F.M.)
F.M.
PUMPING STATION (PS)
INVERT ELEVATION
(MDC DATUM)
198.24
INTERCEPTOR SIZE
24"x 27"
130
MDC SECTION NUMBER
DRAINAGE DIVIDES
SERVICE AREA BOUNDARIES
SERVICE AREAS OF
EXISTING PUMPING STATIONS


BROOKLINE
WELLESLEY
BOSTON
NEEDHAM
UPPER NEPONSET VALLEY SEWER
River
WELLESLEY EXTENSION RELIEF SEWER
WELLESLEY EXTENSION SEWER
WELLESLEY EXTENSION RELIEF SEWER
NEPONSET VALLEY SEWER
NEW NEPONSET VALLEY SEWER
MILTON
Neponset
Charles
DOVER
WESTWOOD
WESTWOOD EXTENSION SEWER
MEDFIELD
NORWOOD
CANTON
MILLIS
WALPOLE
River
WALPOLE EXTENSION SEWER
STOUGHTON EXTENSION SEWER
River
Neponset
NORFOLK
SHARON
STOUGHTON


CALF PASTURE P.S.
BOSTON
DORCHESTER INTERCEPTOR
SQUANTUM P.S.
HULL
NUT ISLAND WWTP.
HOUGHS NECK P.S.
NEPONSET
SEWER
WELLESLEY EXTENSION
RELIEF SEWER
River
QUINCY P.S.
BRAINTREE-WEYMOUTH P.S.
BRAINTREE-WEYMOUTH
EXTENSION SEWER
HIGH LEVEL SEWER
QUINCY
HINGHAM P.S.
NEW NEPONSET
VALLEY SEWER
LOWER BRAINTREE
CONNECTING SEWER
HINGHAM F.M.
Neponset
MILTON
Weymouth
Fore
River
Back
Weymouth
River
HINGHAM
BRAINTREE
BRAINTREE-RANDOLPH EXTENSION SEWER
WEYMOUTH
CANTON
NOR
STOUGHTON EXTENSION SEWER
ROCKLAND
STOUGHTON

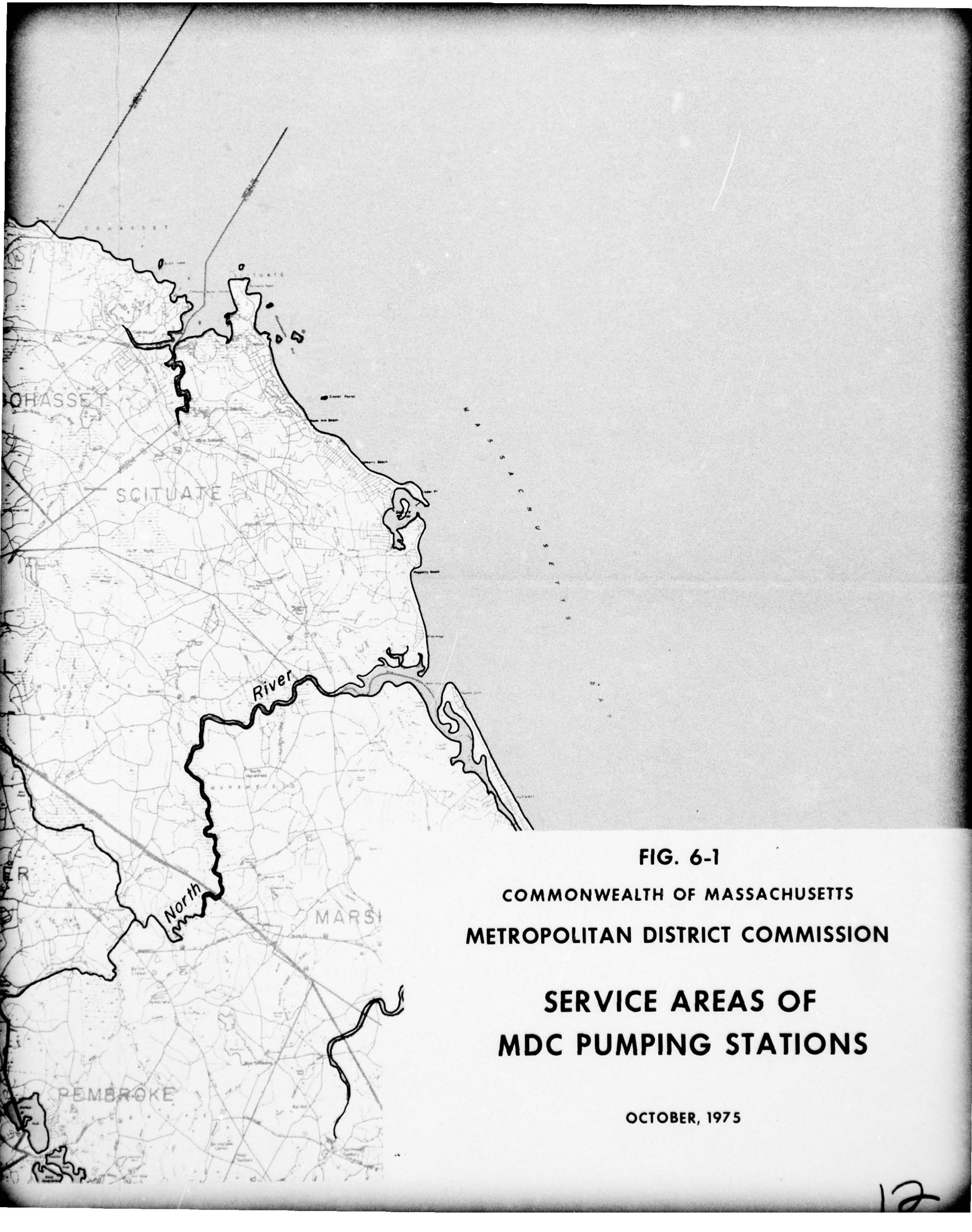


FIG. 6-1

COMMONWEALTH OF MASSACHUSETTS

METROPOLITAN DISTRICT COMMISSION

SERVICE AREAS OF MDC PUMPING STATIONS

OCTOBER, 1975

12